"Cutting Edge of Posture and Gait Research"

# PROGRAM

## 2nd Joint World Congress

## ISPGR / Gait & Mental Function

## June 22nd-26th, 2013

## Akita, Japan

### Akita View Hotel and Atorion

ispgr International Society for Posture & Gait Research

Gait and Mental Function

www.ispgr.org

2nd Joint ISPGR and Gait & Mental Function Congress

# Program-at-a-Glance

Akita View Hotel | June 22 - 26, 2013

ISPGR International Society for Posture & Gait Research

Gait and Mental Function

## Saturday 22-Jun

- Registration (8:00 - 8:15)
- Satellite Meeting, Lena Ting (09:00 - 12:30), College Plaza
- Free Time
- Board Meeting (14:00 - 16:00), Kiku
- Opening Ceremony (16:30 - 17:15) Hisho A
- Opening Keynote Lecture, Berthoz (17:20 - 18:20) Hisho A
- Welcome Demonstration (18:20 - 19:00)
- Welcome Reception (19:00 - 20:30), Hisho B
- Registration /Information Desk Open
- Exhibitor Move-in

## Sunday 23-Jun

- Registration (8:00 - 8:15)
- Keynote Lecture I, Pearson (8:30 - 9:30) Hisho A
- Break (9:30 - 10:00)
- Oral Session
  - O.1 Tools & Methods I (10:00 - 11:00)
  - O.2 Tools and Methods II (11:00-12:00), Hisho A
- Oral Session
  - O.3 Neurological diseases I (10:00 - 1100)
  - O.4 Neurological diseases II (11:00 - 12:00), Hisho B
- Oral Session
  - O.5 Cognitive & cognitive impairments (10:00 - 11:00)
  - O.6 Habilitation & rehabilitation (11:00 - 12:00), Botan
- Lunch & Exhibitors (12:00 - 14:00)
- Free Time / Excursions (12:00 - 19:00)
- Consensus Meeting on Stabilometry - Towards International Standardization (13:00-14:30), Tsubaki
- Symposia IX, B. Bloem, Y. Okuma (13:00 - 15:00), Botan
- User Guide to Maximising the ISPGR Website (15:00 - 15:30), Tsubaki
- Free Time / Excursions (12:00 - 19:00)
- Exhibitors
- Registration /Information Desk Open

## Monday 24-Jun

- Registration (8:00 - 8:15)
- Keynote Lecture II, Dieterich (8:30 - 9:30) Hisho A
- Break (9:30 - 10:00)
- Symposia I, Joyce Fung (10:00 - 12:00), Hisho A
- Symposia II, Jorunn L. Helbostad (10:00 - 12:00), Hisho B
- Symposia III, Toshihisa Murofushi (10:00 - 12:00), Botan
- Lunch Seminar (12:00 - 13:00), Thomas Brandt - Hisho A, Kimitaka Nakazawa - Hisho B
- Break (13:00 - 13:15)
- Poster Session I (13:15 - 15:15), Atorion B1F.2F.
- Break (15:15 - 15:30)
- Poster Session II (15:30 - 17:30), Atorion B1F.2F.
- Dinner (17:30 - 18:30), Hisho A/B
- Concert, Collaboration of Japanese and Western Music (19:00 - 20:30), Atorion 4F
- Exhibitors
- Registration /Information Desk Open

## Tuesday 25-Jun

- Registration (8:00 - 8:15)
- Keynote Lecture III, Robinovich (8:30 - 9:30) Hisho A
- Break (9:30 - 10:00)
- Poster Session III (10:00 - 12:00), Atorion B1F.2F
- Buffet Lunch Exhibitors
- Seminar (Mitobe) (12:30-13:00) Hisho A
- ISPGR Member Meeting (13:00 - 14:00), Hisho A
- Promising Young Scientist Lecture (14:00 - 14:30) Hisho A
- Oral Session
  - O.7 Falls & falls prevention (14:30 - 15:30)
  - O.8 Tools & methods III (15:30 - 16:30), Hisho A
- Oral Session
  - O.9 Neurological diseases III (14:30 - 15:30)
  - O.10 Neurological diseases IV (15:30 - 16:30), Hisho B
- Oral Session
  - O.11 Sensorimotor control I (14:30 - 15:30)
  - O.12 Falls & falls prevention II (15:30 -16:30), Botan
- Poster Session IV (16:30 - 18:30), Atorion B1F.2F
- Gala Dinner (19:00 - 21:00), Hisho A/B
- Exhibitors
- Registration /Information Desk Open

## Wednesday 26-Jun

- Registration (8:00 - 8:15)
- Keynote Lecture IV, Hausdorff (8:30 - 9:30) Hisho A
- Break (9:30 - 10:00)
- Symposia IV, Fay Horak (10:00 - 12:00), Hisho A
- Symposia V, Adolfo Bronstein (10:00 - 12:00), Hisho B
- Symposia VI, Lynn Rochester (10:00 - 12:00), Botan
- Lunch Seminar (12:00 - 13:00), Yoshiyuki Sankai - Hisho A, Dai Yanagihara - Hisho B
- Symposia VII, Vivian Weerdesteyn (13:15 - 15:00), Hisho A
- Symposia VIII, Paul Hodges (13:15 - 15:00), Hisho B
- Break (15:00 - 15:15)
- Oral Session
  - O.13 Tools & methods IV (15:15 - 16:15)
  - O.14 Tools & methods V (16:15 - 17:15), Hisho A
- Oral Session
  - O.15 Sensorimotor control II (15:15 - 16:15)
  - O.16 Sensor control III (16:15-17:15), Hisho B
- Oral Session
  - O.17 Modelling (15:15 - 16:15)
  - O.18 Vestibular functions & disrorders (16:15-17:15), Botan
- Closing Ceremony (17:15- 18.30), Hisho A
- Exhibitors
- Registration /Information Desk Open

# Table of Contents

# About ISPGR

The International Society for 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 for Posture and Gait Research** was formed in 1969 under the name the International Society of Posturography, by a group of basic scientists and clinicians who had similar interests in quantifying postural sway during stance. Most of the Society members in the first years were from Europe and Japan. The first meetings took place in **Madrid** (1971), **Smolenica** (1973), **Paris** (1975), **Sofia** (1977), **Amsterdam** (1979), **Kyoto** (1981) and **Houston** (1983). At the 1983 meeting in Houston the founders realized that interest in posturography had expanded to include the entire area of balance and gait control and at the annual meeting in 1986, the Society was renamed to its current name. By the 1992 meeting in Portland, Oregon, the Society had grown to over 300 members worldwide and member interests expanded to include sensory and motor control neurophysiology, biomechanics, movement disorders, neural circuitry, vestibular function, neurological disorders, effects of development and aging, rehabilitation, robotics, modeling, neural compensation, and motor learning as related to control of balance and gait.

In 2010, recognizing opportunities to grow the organization, the board secured professional association and conference management support and made the decision to host a conference with the Gait and Mental Function Conference. 2013 marks the 2nd Joint ISPGR and GMF Congress in **Akita, Japan**.

## Gait and Mental Function History

The Gait and Mental Function (GMF) Congress was initiated by key researchers and clinicians to review the science that links gait and mental function and to move this new, but rapidly emerging field forward. As a result, the Inaugural Congress, chaired by Nir Giladi, was held in 2006 in Madrid, Spain. The first GMF congress was a great success, in drawing attention to the fact that gait – long regarded as an automatic motor function – is in fact strongly influenced by cognitive functions such as attention, executive function and visual spatial orientation. At the time, the relationships between mental functions, walking and fall risk were garnering much attention in the scientific community, and the congress provided an ideal forum for the discussion of these relationships in a cross-disciplinary forum. This congress, and the subsequent two congresses, developed an active and vibrant cross-disciplinary forum by bringing together researchers and clinicians from a wide variety of fields, including cognitive neuroscientists, neurologists, neurophysiologists, psychiatrists, geriatricians, gerontologists, rehabilitation specialists, physical and occupational therapists, as well as researchers of gait, posture and mental functions. Subsequent GMF Congresses were held in 2008 in Amsterdam, under the chairmanship of Bastiaan R. Bloem and Marcel Olde Rikkert, and in 2010 in Washington, DC, with Lisa Schulman and Stephanie Studenski leading the organization. These Congresses built on the work and interchange initiated at the first Congress and developed additional "hands on" workshops that strengthened the goal of bringing researchers and clinicians together to discuss the implications and opportunities inherent in this field of science.

# Dear Colleagues

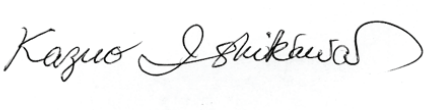
It is a great pleasure and honor for us to welcome you to the 2nd Joint World Congress of ISPGR and Gait and Mental Function in Akita, Japan. The 2013 ISPGR Congress in Akita is the third to be held in Japan. Most of you are aware that this is the postponed ISPGR congress which had been scheduled in June 2011 and was cancelled due to the aftermath of the earthquake in northeast Japan. However, thanks to your membership and heart felt support in addition to the generosity of our sponsors, we are delighted to host this meeting here in Akita at this time.

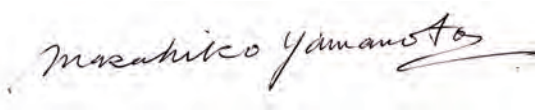
We are pleased to announce that the total number of submitted papers is almost the same as those for the cancelled congress in 2011. I warmly thank all participants for supporting ISPGR, and connecting as a strong society. We can anticipate many new scientific insights and a valuable exchange of scientific findings and knowledge, and deepen our friendships and our society as well. We sincerely hope that every participant can enjoy the whole program and have fantastic memories of this world congress.

The theme for this world congress is "Cutting Edge Posture and Gait Research". The program includes five key note speakers: Professors Alain Berthoz, Keir Pearson, Marianne Dietrich, Stephen Robinovitch, and Jeffery Hausdorff, who will present research updates from their field of expertise and from basic to clinical fields, on posture and gait. Professors Thomas Brandt, Kimitaka Nakazawa, Yoshiyuki Sankai, Dai Yanagihara, and Kazutaka Mitobe will share with us their recent research findings from clinical research to robotics during the luncheon seminars. In addition to these, there will be nine featured symposia, covering almost all fields of control system of posture and gait. Furthermore, 72 oral presentations and 302 posters are to be presented during the congress.

A special and original Akita exhibition and show will be presented at the Akita Kanto Welcome Event, Evening Concert and Gala Dinner. We look forward to sharing our city with you and we hope that everyone will enjoy the program at the 2nd Joint World Congress of ISPGR and Gait and Mental Function.

Welcome to Akita!





Congress Chair:
**Kazuo Ishikawa**, MD, PhD

Congress Co-Chair
**Masahiko Yamamoto**, MD, PhD

# Leadership

## President

**Emily A. Keshner**, PT, EdD
Chair and Professor, Department of Physical Therapy, College of Health Professions, Temple University, Philadelphia, United States

## Treasurer

**Mark Carpenter**, PhD
Canada Research Chair, Associate Professor, School of Kinesiology, University of British Columbia, Vancouver, Canada

## Vice Presidents

**Kazuo Ishikawa**, MD, PhD
Professor and Chairman, Department of Otorhinolaryngology & Head-Neck Surgery, Akita Graduate School of Medicine, Akita University, Japan

**Brad McFadyen**
Dept of Rehabilitation, Laval University, Quebec City, Canada

## Secretary

**Sandra Brauer** (Asia-Pacific) PhD, BPhty
Division of Physiotherapy, The University of Queensland, Brisbane, Australia

## Elected Representatives

**Vivian Weerdesteyn** (Europe), PhD
Assistant Professor, Department of Rehabilitation, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

**Jeffrey Hausdorff** (Asia), PhD
Director of the Laboratory for the Analysis of Gait and Neurodynamics at Tel-Aviv Sourasky Medical Center (TASMC), Tel-Aviv, Israel,

**Mark Hollands** (Europe), BSc, PhD,
Reader in Sensorimotor Neuroscience, Liverpool John Moores University, UK

**Stephen Robinovitch** (North America), PhD, MSc
Professor, School of Engineering Science, Simon Fraser University, Vancouver, Canada

## Past President

**Bastiaan R. Bloem**, MD, PhD, Full Professor in Neurology, with a specific chair in Movement Disorders, Department of Neurology, University Medical Center, St Radboud, Nijmegen, Netherlands

## Local Organizing Committee

**Raymond Chong**
Georgia Health Sciences University, USA

**Katsumi Doi**
Kinki University, Japan

**Yoshihiro Ehara**
Niigata University of Health and Welfare, Japan

**Katsuo Fujiwara**
Kanazawa University, Japan

**Nobuhiko Furuya**
Gunma University, Japan

**Takashi Hanakawa**
National Center of Neurology and Psychiatry, Japan

**Masahiro Iida**
Tokai University, Japan

**Yatsuji Ito**
Gifu University, Japan

**Juichi Ito**
Kyoto University, Japan

**Mi Jung Kim**
Hanyang University, Korea

**Ken Kitamura**
Tokyo Medical and Dental University, Japan

**Izumi Koizuka**
St.Marianna University School of Medicine, Japan

**Toshiki Matsunaga**
Akita University, Japan

**Futoshi Mori**
Yamaguchi University, Japan

**Toshihisa Murofushi**
Teikyo University School of medicine University Hospital, Mizonokuchi Japan

**Hisao Nagata**
The Institute for Science of Labour, Japan

**Yasushi Naito**
Kobe City Medical Center General Hospital, Japan

**Kimitaka Nakazawa**
Tokyo University, Japan

**Hisato Ohno**
Railway Technical Research Institute, Japan

**Yasuyuki Okuma**
Juntendo University Shizuoka Hospital, Japan

**Yoichi Shimada**
Akita University, Japan

**Hideo Shojaku**
University of Toyama, Japan

**Mamoru Suzuki**
Tokyo Medical University, Japan

**Noriaki Takeda**
The University of Tokushima, Japan

**Yasuhiko Takei**
Kitasato University Kitasato Institute Hospital, Japan

**Toshihiro Tsuzuku**
College de France, CNRS, LPPA, Japan

**Shinichi Usami**
Shinshu University, Japan

**Yukio Watanabe**
University of Toyama, Japan

**Toshiyasu Yamamoto**
Okayama University of Science, Japan

**Toshiaki Yamanaka**
Nara Medical University, Japan

**Hideo Yamane**
Osaka City University, Japan

**Hiroshi Yamashita**
Yamaguchi University, Japan

**Dai Yanagihara**
Tokyo University, Japan

**Min Yin**
Nanjing Medical University, China

**Tomoe Yoshida**
Toho University Sakura Medical Center, Japan

**Yi-Ho Young**
National Taiwan University Hospital, Taiwan

## Scientific Committee

The Scientific Committee is responsible for developing the scientific program for the International Congress, along with abstract review process.

**John Allum**
University Hospital Basel, Switzerland

**Alain Berthoz**
Collège de France, France

**Bastiaan Bloem**
Radboud University Nijmegen Medical Center, Netherlands

**Sandra Brauer**
The University of Queensland, Australia

**Adolfo Bronstein**
Imperial College London, UK

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

**Lorenzo Chiari**
University of Bologna, Italy

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**Joyce Fung**
McGill University, USA

**Jorunn Helbostad**
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**John Jeka**
University of Maryland, USA

**Emily Keshner**
Temple University, USA

**Kyu-Sung Kim**
Inha University Hospital, Korea

**Stephen Lord**
Neuroscience Research Australia, Australia

**Mans Magnusson**
Lund University Hospital, Sweden

**Brian Maki**
Toronto Rehabilitation Institute / University of Toronto, Canada

**Caterina Rosano**
University of Pittsburgh, USA

**Lisa Shulman**
University of Maryland School of Medicine, USA

**Stephanie Studensk**
University of Pittsburgh, USA

# Leadership

# Congress General Information

## Meeting Venues

**College Plaza**, Akita, Japan
The Satellite Meeting

**The Akita View Hotel**, Akita, Japan
All conference sessions will take place at this location

**The Atorion Building**, Akita, Japan
All poster sessions will take place at this location

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

## Registration

**Joint ISPGR & GMF Congress**
Registration for the Congress includes admission to all sessions, a copy of the printed program, access to all coffee breaks and lunches daily. In addition, all social events, including the Welcome Reception, Gala Dinner, Concert and Closing Ceremony are included in your registration. If you are staying at the Congress Headquarters, the Akita View Hotel, breakfast is included in your room rate.

**Additional Tickets**
Tickets can be purchased separately for your guests and/or children for all social functions.

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

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

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

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

| | | |
|---|---|---|
| Saturday | June 22 | 15:00 – 20:00 |
| Sunday | June 23 | 08:00 – 14:00 |
| Monday | June 24 | 08:00 – 16:00 |
| Tuesday | June 25 | 08:00 – 16:00 |
| Wednesday | June 26 | 08:00 – 16:00 |

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

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

All speakers in Symposia and Oral Sessions must upload their presentations at least 60 minutes prior to their presentation at speaker information desk situated in the foyer outside Hisho A and Hisho B meeting room.

## Social Events:

**The Welcome Reception**
Saturday June 22, 18:20 – 20:30

The Welcome Event will be held directly after the opening lecture. This one-of-a-kind "Kanto" festival demonstration and a traditional Japanese drumming performance is not to be missed! Connect with friends and colleagues, and experience the local culture.

Located: Akita View Hotel

**Monday Evening Dinner**
Monday June 24, 17:30 – 18:30

This dinner will take place at the Akita Hotel, Hisho A & B

**Collaboration of Japanese and Western Music**
Monday June 24, 19:00-20:30

You can enjoy a marvelous encounter of Japanese and Western music! This concert will take place at the Akita Integrated Life Cultural Hall / Museum Atorion.

**Gala Dinner**
Tuesday June 25, 19:00 – 21:00

A great networking opportunity for all delegates! This will take place at the Akita View hotel, Hisho A & B

**Closing ceremony**
Wednesday June 26, 17:15 – 18:30

This closing event will take place in Hisho A

## Board Service

Board elections are held annually around the conference dates. Board nominations are open to all members in good standing. If you are interested in serving on the ISPGR Board or one of the ISPGR Committees please see one of the existing Board members or contact the Secretariat.

## ISPGR Secretariat

Society Secretariat & Conference Management

De Armond Management Ltd.

**Marischal De Armond**
**Jude Ross**
**Breda Hamill**

E-mail: ***ispgr@ispgr.org***

## Poster Information

**Set-up and Removal**
There are four Poster Sessions during the Congress, and posters will remain in situ for the duration of the Congress and every presenter must set-up and remove their posters during the following times:

| | | |
|---|---|---|
| Set-up: | Monday, June 24 | 07:30 – 08:30 |
| Remove: | Tuesday, June 25 | 18:30 – 19:00 |

**Presentation Times**

**Poster Session 1: (odd numbers, < 150)**
Dedicated time: Monday, June 24 13:15 – 15:15

**Poster Session 2: (odd numbers, > 150)**
Dedicated time: Monday, June 24 15:30 – 17:30

**Poster Session 3: (even numbers, > 150)**
Dedicated time: Tuesday, June 25 10:00 – 12:00

**Poster Session 4: (even numbers, < 150)**
Dedicated time: Tuesday, June 25 16:30 – 18:30

Information on Poster Authors (Lead), Poster Numbers and Poster Titles begins on page 46.
Poster sessions can be identified by the colour card on your allocated poster board, please ensure these are visible during dedicated times.

For a complete copy of all the poster abstracts, please visit the ISPGR website, where you can download an electronic copy.

Easy reference Poster floor plans can be found on page 72.

## Staff

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

## Membership

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

## Member Benefits

- Exclusive opportunity to submit abstracts for review and consideration for presentation at Society Meetings
- Opportunity to register for Society Meetings at reduced registration rates
- Professional development and networking
- Access to online resources and conference proceedings
- Opportunity to submit applications for student scholarships and awards
- 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 annual elections for the Board of Directors

- Opportunity to stand for election to the Board of Directors
- Opportunity to serve as an officer of the Board of Directors
- Opportunity to serve on Society committees

## Member Categories

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

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

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

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

# Pre-Congress Satellite Meeting

**Neural mechanisms underlying motor deficits and neurorehabilitation**

Presenters: **Lena H Ting, J. Lucas McKay, Carolynn Patten, Randy D Trumbower**

Location: College Plaza

Description
Clinical tests lack the sensitivity to reveal the neural mechanisms underlying motor deficits and thus to inform rehabilitation that may lead to more specific and targeted interventions. Muscle activity reflects relevant neural activity, but we lack appropriate tools for quantifying muscle coordination and the resulting functional implications. Lena Ting will present advances in analysis of electromyographic (EMG) signals using muscle synergy and sensorimotor feedback analysis to reveal mechanisms of motor impairment in gait and balance, with examples in stroke and spinal cord injury. Lucas McKay will demonstrate changes in sensorimotor feedback revealed during reactive balance in individuals with Parkinson's Disease following an adapted tango intervention. Carolynn Patten will present differences in muscle synergies in stroke survivors that may discriminate responders from non-responders to a neurorehabilitation intervention. Randy Trumbower will discuss changes in muscle synergy structure for overground walking after single-day acute intermittent hypoxia treatment in individuals with chronic motor-incomplete spinal cord injury. In addition to the oral presentations, we are soliciting a limited number of posters for a focused poster session on the topic. Posters need not be different from those presented at the main ISPGR meeting, but are intended to generate discussion around understanding neural mechanisms underlying rehabilitation.

# Awards

**Research and Innovation Award in memory of Aftab Patla**

Sponsored, once again, by Northern Digital, Inc. the congress will offer two student poster presentation awards in honour of Dr. Aftab Patla. One award will be for basic science and one for clinical science. Recipients will be chosen from a panel of researchers based on several criteria including:

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

The award winner will be announced on the last day of the conference, Wednesday June 26
Note: This award is for student poster submissions only

**Promising Young Scientist Award Winner 2013**

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

**Alain Frigon**, Université de Sherbooke.

Alain is an Assistant Professor in the Department of Physiology and Biophysics at the Université de Sherbooke, Canada.

Through his research, Alain has:

- Provided new knowledge on the functional recovery of locomotion following spinal cord injury
- Shown that different motor rhythms produced by the mammalian spinal cord have specialized control mechanisms
- Shown that interlimb coordination during quadrupedal locomotion is asymmetrically organized.

Alain's presentation will take place on **Tuesday, June 25 from 14:00 – 14:00** in Hisho A room.

# Detailed Program

## Saturday, June 22, 2013

09:00-12:30 **Satellite Meeting**
**Neural mechanisms underlying motor deficits and neurorehabilitation**

**Satellite Chair:** Lena H. Ting, Emory University and Georgia Institute of Technology

**Participants:**
Lena H. Ting, Emory University and Georgia Institute of Technology
J. Lucas McKay, Emroy and Georgia Tech
Carolynn Patten, VA Medical Centre and University of Florida
Randy D. Trumbower

*(College Plaza, Meitokukan Bld. 2F)*

16:30-17:15 **Opening Ceremony**

*(Hisho A)*

17:20-18:20 **K.O Opening Keynote Lecture**

**The neuro-cognitive control and development of gait in health and disease. Recent findings**

Alain Berthoz, Collège de France, France

**Chair:** Shigemi Mori, National Institute for Physiological Sciences, Japan

*(Hisho A)*

18:20-19:00 **Akita Kanto Welcome Event**

*Akita View Hotel*

19:00-20:30 **Welcome Reception**

*(Hisho B)*

## Sunday, June 23, 2013

08:30-09:30 **K.1 Keynote Lecture I**

**Working memory for obstacle avoidance during walking**

Keir Pearson, University of Alberta, Canada

**Chair:** Stephen Lord, University of New South Wales, Australia

*(Hisho A)*

10:00-11:00 **O.1 Oral Session: Tools and Methods I**

**Chair:** Tatuya Yamasoba, University of Tokyo, Japan

**O.1.1 The instrumented timed up and go test: potential for assessing alterations in Parkinson's disease clinical subtypes**
Aner Weiss, Tel Aviv Sourasky Medical Center, Israel

**O.1.2 Structural instability of human gait:** Espen Ihlen, Norwegian University of Science and Technology, Norway

**O.1.3 Postural control during real and virtual obstacle avoidance:** Hirofumi Ida, Jobu University, Japan

**O.1.4 Vestibular stimulation by static magnetic fields:** Omar Mian, University College London, England

*(Hisho A)*

11:00-12:00 **O.2 Oral Session: Tools and Methods II**

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

**O.2.1 Plantar arch analysis during stepping on asperities to design a mechanical foot:** Yusuke Ogawa, Tokyo University of Agriculture and Technology, Japan

**O.2.2 Walking stability measurement based on plantar skin deformation:** Takayuki Shiina, Tokyo University of Science, Japan

**O.2.3 Wearable technology in freezing gait of Parkinson's disease: Literature review:** Sylvia Liew HX, Tan Tock Seng Hospital, Singapore

**O.2.4 An instrumented 3-day activity monitoring in Parkinson's disease clinical subtypes:** Aner Weiss Tel Aviv Sourasky Medical Center, Israel

*(Hisho A)*

10:00-11:00 **O.3 Oral Session: Neurological Diseases I**

**Chair:** Takashi Hanakawa, National Center of Neurology and Psychiatry, Japan

**O.3.1 Asymmetric pedunculopontine network connectivity in freezing of gait from Parkinson's disease:** Brett Fling, Oregon Health and Science University, USA

**O.3.2 Supra-spinal control of locomotion in freezers and non-freezers with Parkinson disease:** Daniel Peterson, Washington University in Saint Louis, USA

**O.3.3 Increased activation of the frontal lobe is associated with freezing of gait in patients with Parkinson's disease: an fNIRS study**: Inbal Maidan, Tel Aviv Souasky Medical Center, Israel

**O.3.4 A practical system for detection of freezing of gait in patients with Parkinson's disease:** Yu-Ri Kwon, Konkuk University, South Korea

*(Hisho B)*

11:00-12:00 **O.4 Oral Session: Neurological Diseases II**

**Chair:** Yasuyuki Okuma, Juntendo University Shizuoka Hospital, Japan

**O.4.1 White matter hyperintensities in Parkinson's disease: Do they explain the disparity between the postural instability gait difficulty and tremor dominant subtypes?:** Talia Herman-Feinstein, Tel Aviv Sourasky Medical Center, Israel

**O.4.2 Differences in gray matter atrophy between Parkinson's disease motor subtypes: possible role of GM as a mediator between motor and cognitive function:** Jeffrey Hausdorff, Tel Aviv Sourasky Medical Center, Sackler School of Medicine, Israel

**O.4.3 Does dysfunction of brainstem reticular structures underlie postural instability in Parkinson's disease?:** Jorik Nonnekes, Radboud University Medical Centre, The Netherlands

**O.4.4 Pedunculopontine nucleus-thalamic cholinergic correlates of postural sensory organization functions in Parkinson disease:** Martijn Muller, University of Michigan, USA

*(Hisho B)*

# Detailed Program

10:00-11:00 **O.5 Oral Session: Cognitive and Cognitive Impairments**

**Chair:** Klaas Postema, University Medical Center Groningen, The Netherlands

**O.5.1 Spatial orientation deficit as an early clinical sign of hippocampal dysfunction in mild cognitive impairment:** Klaus Jahn, University of Munich, Germany

**O.5.2 Effects of concussion on lower extremity inter-joint coordination during obstacle crossing and dual-task walking:** Li-Shan Chou, University of Oregon, USA

**O.5.3 Associations between gait variability and sustained attention in a community dwelling nationally representative population sample:** Isabelle Killane, Trinity College Dublin, Ireland

**O.5.4 Dual-tasking during locomotor skill acquisition impairs the expression of the locomotor after-effect:** Mitesh Patel, Imperial College London, England

*(Botan)*

11:00-12:00 **O.6 Oral Session: Habilitation and Rehabilitation**

**Chair:** Yi-Ho Young, National Taiwan University Hospital, Taiwan

**O.6.1 The relationship between physical capacity and both fatigue and fatigability in older people?:** Thorlene Egerton, Norwegian University of Science and Technology, Norway

**O.6.2 The effect of visual motion stimulation on visual dependency in patients with visual vertigo:** Pei-Yun Lee, Imperial College London, England

**O.6.3 Effects of preparatory cued step training on gait performance in people with Parkinson's disease:** Margaret Mak, The Hong Kong Polytechnic University, Hong Kong

**O.6.4 Retraining function with exercise based computer games for people with Parkinson's disease: PD-Kinection:** Brook Galna, Newcastle University, England

*(Botan)*

12:00-14:00 **Lunch**

13:00-15:00 **S.9 Symposium IX**

**Balance and gait disorders: a symptom-based approach**

**Chairs:** Bastiaan R. Bloem University Medical Center, The Netherlands and Yasuyuki Okuma, Juntendo University Shizuoka, Japan

**Participants:**
Bastiaan R. Bloem, University Medical Center, The Netherlands
Corinne Horlings, Radboud University, Nijmegen, The Netherlands
Yasuyuki Okuma, Juntendo University Shizuoka, Japan
Takashi Hanakawa, National Centre of Neurology and Psychiatry, Japan

*(Botan)*

13:00-14:30 **Consensus meeting on stabilometry - toward international standardization**

**Chairs:** Lorenzo Chiari, University of Bologna, Italy,
Masahiko Yamamoto, Toho University School of Medicine, Japan and
Pierre Marie Gagey, Institut de Posturologie, France

*(Tsubaki Room, Akita View Hotel)*

15:00-15:30 **User guide to maximising the ISPGR website www.ispgr.org**

**Chair:** Breda Hamill, De Armond Management, Canada

*(Tsubaki Room)*

## Monday, June 24, 2013

08:30-09:30 **K.2 Keynote Lecture II**

**Functional imaging of vestibular disorders with implications for rehabilitation**

Marianne Dieterich, Ludwig-Maximilians-University of Munich, Germany

**Chair:** Adolfo Bronstein, Imperial College London, England

*(Hisho A)*

10:00–12:00 **S.1 Symposium I**

**Advanced technologies to enhance sensorimotor integration in postural control**

**Chair:** Joyce Fung, McGill University, Canada

**Participants:**
Joyce Fung, McGill University, Canada
W. Geoffrey Wright, Temple University, USA
Emily Keshner, Temple University, USA
Masahito Mihara, Osaka University, Japan

*(Hisho A)*

**S.2 Symposium II**

**Physical activity monitoring with focus on physical behaviour**

**Chair:** Jorunn L. Helbostad, Norwegian University of Science and Technology, Norway

**Participants:**
Malcolm Granat, Caledonian University, Scotland
Sebastien Chastin, Caledonian University, Scotland
Kristin Taraldsen, Norwegian University of Science and Technology, Norway
Thorlene Egerton, Norwegian University of Science and Technology, Norway

*(Hisho B)*

**S.3 Symposium III**

**Disturbances of posture, gait, and space orientation by vestibular dysfunction**

**Chair:** Toshihisa Murofushi, Teikyo University Mizonokuchi Hospital, Japan

**Participants:**
E. Omi, Akita University, Japan
Y.H. Young, Taiwan University, Taiwan
C. Fujimoto, Tokyo University, Taiwan
Klaus Jahn, University of Munich, Germany

*(Botan)*

# Detailed Program

12:00-13:00 **Lunch Seminar**

**Effects of sensory input on spinal and corticospinal excitabilities during robot-assisted stepping**

Kimitaka Nakazawa, The University of Tokyo, Japan

**Chair:** Kichiro Taguchi, Shinshu University, Japan

*(Hisho B)*

**Visual height intolerance and imbalance**

Thomas Brandt, Ludwig-Maximilians-University, Germany

**Chair:** M. Magnusson, Lund University Hospital, Sweden

*(Hisho A)*

13:15-15:15 **Poster Session I**

*(Atorion)*

15:15-15:30 **Break**

15:30-17:30 **Poster Session II**

*(Atorion)*

17:30-18:30 **Welcome Dinner**

*(Hisho B)*

19:00-20:30 **Concert**

**Collaboration of Japanese and Western Music**

*(Atorion Concert Hall)*

## Tuesday, June 25, 2013

08:30-09:30 **K.3 Keynote Lecture III**

**Protective responses in older adults for avoiding injury during falls**

Stephen N. Robinovitch, Simon Fraser University, Canada

**Chair:** Jim Frank, University of Waterloo & St. Jerome's University, Canada

*(Hisho A)*

10:00-12:00 **Poster Session III**

*(Atorion)*

12:00-13:00 **Buffet Lunch / Exhibitors**

*(Hisho A & B Foyer)*

12:30-13:00 **Lunch Seminar**

**Magnetic motion capture system as a convenient posture measuring tool**

Kazutaka Mitobe, Akita University, Japan

**Chair:** M. Yamamoto, Toho University Sakura Medical Center, Japan

*(Hisho A)*

13:00-14:00 **ISPGR Member Meeting**

*(Hisho A)*

14:00-14:30 **Promising Young Scientist Lecture**

**The study of interlimb coordination during split-belt locomotion before and after spinal cord injury in the adult cat**

Alain Frigon, Universite de Sherbrooke, Canada

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

*(Hisho A)*

14:30-15:30 **O.7 Oral Session: Falls and Falls Prevention**

**Chair:** Hisao Nagata, Institute for Science of Labour, Japan

**O.7.1 White matter integrity and fall risk in older people: A diffusion tensor imaging study:** Kim Delbaere, University of New South Wales, Australia

**O.7.2 White matter microstructural organization and gait stability in older adults:** Sjoerd Bruijn, K.U. Leuven, Belgium

**O.7.3 Higher level gait disorders: the role of midbrain neurodegeneration:**

Adèle Demain, CR-ICM 1er étage CIC, France

**Chair:** Bradford McFadyen, Laval University

**O.7.4 Predicting falls among people with Parkinson's disease with and without cognitive impairment:** Ann Ashburn, University of Southampton, England

*(Hisho A)*

15:30-16:30 **O.8 Oral Session IV: Tools and Methods III**

**Chair:** Juichi Ito, Kyoto University, Japan

**O.8.1 Reliability and validity of a modular-based gait analysis system for assessing temporal spatial gait parameters in normal subjects:** Pootithan Phonrod, King Mongkut's University of Technology Thonburi, Thailand

**O.8.2 A 3D-stabilogram as a new method to visualize and analyze postural sway during standing:** Beatrix Vereijken, Norwegian University of Science and Technology, Norway

**O.8.3 Detailed ambulatory 3D gait analysis with only body worn sensors - quality and clinical relevance in multi-moment progress monitoring in post operative ACL rehabilitation:** Chris Baten, Roessingh Research and Development, The Netherlands

**O.8.4 Gait asymmetry assessment by Dynamic Time Warping applied to motion capture data:** Adam Switonski, Polish-Japanese Institute of Information Technology, Poland

*(Hisho A)*

14:30-15:30 **O.9 Oral Session V: Neurological Diseases III**

**Chair:** Lorenzo Chiari, University of Bologna, Italy

**O.9.1 Gait is selectively affected by disease severity in early Parkinson's disease:** Sue Lord, Newcastle University, England

**O.9.2 The effect of a 4-week training program in people with Parkinson's disease on actual mobility: a single blind randomised clinical trial:** Sandra Brauer, The University of Queensland, Australia

**O.9.3 Individuals with none, one, two, but not three risk factors of Parkinson´s disease differ significantly to Parkinson´s like postural deficits in 715 healthy elderly:** Sandra Hasmann, University of Tuebingen, Germany

**O.9.4 The effects of localised temperature changes on walking and neuromuscular function in hereditary and spontaneous spastic paraparesis:** Jon Marsden, Plymouth University, England

*(Hisho B)*

15:30-16:30 **O.10 Oral Session: Neurological Diseases IV**

**Chair:** Futoshi Mori, Yamaguchi University, Japan

**O.10.1 Sensory integration in postural control of dyslexic children:** Jose Barela, University of Cruzeiro do Sul, Brazil

**O.10.2 Trunk bradykinesia and foveation delays during whole-body turns in spasmodic torticollis:** Adolfo Bronstein, Imperial College London, England

**O.10.3 Cutaneous reflex modulation and self-induced reflex attenuation in cerebellar patients:** Wouter Hoogkamer, KU Leuven, Belgium

**Effect of dual-tasking on intentional versus reactive balance control:** Tanvi Bhatt, University of Illinois, USA

*(Hisho B)*

14:30-15:30 **O.11 Oral Session: Sensorimotor Control I**

**Chair:** Jim Frank, University of Waterloo & St. Jerome's University, Canada

**O.11.1 Effects of limiting anterior displacement of the center of foot pressure on anticipatory postural control during bilateral arm flexion:** Katsuo Fujiwara, Kanazawa University, Japan

**O.11.2 Transient sensory reorganisation for body sway regulation with intermittent finger tip feedback is affected by inhibition of the left prefrontal cortex using rTMS:** Leif Johannsen, Technische Universität München, Germany

**O.11.3 Absence of transfer in postural adaptation to moving platform across voluntary sway and arm raising tasks:** Masahiro Shinya, The University of Tokyo, Japan

**O.11.4 The ability to recover balance with a single backward step in people after stroke is highly dependent on leg inclination angle at foot contact:** Digna de Kam, Radboud University Nijmegen Medical Centre, The Netherlands

*(Botan)*

15:30-16:30 **O.12 Oral Session: Falls and Falls Prevention II**

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

**O.12.1 Ankle dorsiflexor strength relates to the ability to restore balance during a backward support surface translation:** Masahiro Fujimoto, University of Maryland School of Medicine, USA

**O.12.2 Towards the automated detection of near falls in patients with Parkinson's disease and idiopathic elderly fallers:** Tal Freedman, Tel Aviv Sourasky Medical Center, Israel

**O.12.3 Does lack of arm movement after tripping cause falls in older adults?:** Mirjam Pijnappels, VU University, The Netherlands

**O.12.4 Long-term changes of fall predictors: preliminary results from the FARSEEING project:** Lorenzo Chiari, University of Bologna, Italy

*(Botan)*

16:30-18:30 **Poster Session IV**

*(Atorion)*

19:00-21:00 **Gala Dinner**

*(Hisho A/B)*

## Wednesday, June 26, 2013

08:30-09:30 **K.4 Keynote Lecture IV**

**What happens when body-fixed sensors meet Parkinsonian gait? A look back to the future**

Jeffrey Hausdorff, Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Israel

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

*(Hisho A)*

10:00-12:00 **S.4 Symposium IV**

**Rehabilitation update**

**Chairs:** Fay Horak, Oregon Health and Sciences University, USA and
Futoshi Mori, Yamaguchi University, Japan

**Participants:**
Bradford McFadyen, Laval University, Canada
Yoichi Shimada, Akita University Graduate School of Medicine, Japan
Gammon Earhart, Washington University in St Louis, USA
Måns Magnusson, Lund University Hospital, Sweden

*(Hisho A)*

**S.5 Symposium V**

**Visuo-cognitive control of balance in vestibular disease**

**Chair:** Adolfo Bronstein, Imperial College London, England

**Participants:**
Adolfo Bronstein, Imperial College London, England
Mark Carpenter, University of British Columbia, Canada
J Staab, Mayo Clinic, USA

*(Hisho B)*

**S.6 Symposium VI**

**Predicting disease: is gait a useful biomarker?**

**Chair:** Jeff Hausdorff, Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Israel

**Participants:**
Lynn Rochester, Newcastle University, England
Anat Mirelman, Tel-Aviv Sourasky Medical Center, Israel
Brook Galna, Newcastle University, UK
Stephen Lord, University of NSW, Australia

*(Botan)*

12:00-13:00 **Lunch Seminar**

**Robot suit HAL and clinical applications for locomotor disorder**

Yoshiyuki Sankai, University of Tsukuba, Japan

**Chair:** Ehara Yoshihiro, Niigata University of Health and Welfare, Japan

*(Hisho A)*

**Role of the cerebellum in adaptive control of posture and locomotion**

Dai Yanagihara, University of Tokyo, Japan

**Chair:** Yukio Watanabe, University of Toyama, Japan

*(Hisho B)*

13:15–16:00 **S.7 Symposium VII**

**What startles can tell us about posture and gait control**

**Chair:** Vivian Weerdesteyn, Radboud University Medical Centre, The Netherlands

**Participants:**
Tim Inglis, School of Kinesiology, University of British Columbia, Canada
Jacques Duysens, KU Leuven, Belgium
Mark Carpenter, University of British Columbia, Canada
Vivian Weerdesteyn, Radboud University Medical Centre, The Netherlands

*(Hisho A)*

**S.8 Symposium VIII**

**Body and mind interactions in pain and postural control**

**Chair:** Paul Hodges, The University Of Queensland, Australia

**Participants:**
Jaap van Dieen, VU University, Amsterdam
Rogerio Hirata, Aalborg University, Denmark
Katsuo Fujiwara, Kanazawa University, Japan

*(Hisho B)*

15:15-16:15 **O.13 Oral Session: Tools and Methods IV**

**Chair:** Mamoru Suzuki, Tokyo Medical University, Japan

**O.13.1 A proposal for a new definition of a near fall:** Inbal Maidan, Tel Aviv Souasky Medical Center, Israel

**O.13.2 Portable fNIRS is a valid technique to study prefrontal cortical activation patterns during dual task walking in Parkinson's patients** Nieuwhof Freek, Radboud University Nijmegen Medical Center, The Netherlands

**O.13.3 Using detrended fluctuation analysis to explain inter-limb coordination and toe clearance control during walking:** Simon Taylor, Victoria University, Australia

**O.13.4 Leg and joint stiffness in children with spastic diplegia cerebral palsy during walking:** Hsing-Po Huang, National Taiwan University, Taiwan

*(Hisho A)*

16:15-17:15 **O.14 Oral Session: Tools and Methods V**

**Chair:** Sandy Brauer, the University of Queensland, Australia

**O.14.1 Towards estimating fall risk from daily life measurements of trunk accelerations in older adults:** Mirjam Pijnappels, VU University, The Netherlands

**O.14.2 Exergaming for balance training in elderly. Part 1: User requirements:** Klaas Postema, University Medical Center Groningen, The Netherlands

**O.14.3 Exergaming for balance training in elderly. Part 2: Quantification of postural control in elderly during balance training using an exergame:** Mike van Diest, INCAS3, The Netherlands

**O.14.4 Effect of task order presentation on dual task interference on gait - consequences and recommendations:** Brook Galna, Newcastle University, England

*(Hisho A)*

15:15-16:15 **O.15 Oral Session: Sensorimotor Control II**

**Chair:** Bradford James, Laval University, Canada

**O.15.1 Effects of aging on visual-vestibular interactions for maintaining stability while standing up from a sitting position:** Grace Kai Yan Lui, Queen's University, Canada

**O.15.2 Extracting self-motion information from visual motion to balance the body:** Brian Day, UCL Institute of Neurology, England

**O.15.3 The relationships between eye movement and turning characteristics during on-the-spot turns:** Rebecca Robins, Liverpool John Moores University, England

**O.15.4 Gaze anticipation during human locomotion remains in darkness:** Colas Authie, UMR7152 LPPA CNRS & Collège de France, France

*(Hisho B)*

16:15-17:15 **O.16 Oral Session: Sensorimotor Control III**

**Chair:** Emily Keshner, Temple University, USA

**O.16.1 Cataract surgery in older people improves gait speed in subdued lighting:** Jorunn L. Helbostad, Norwegian University of Science and Technology, Norway

**O.16.2 Increase in frontal brain activation during dual tasking in healthy young individuals: an fNIRS study:** Anat Mirelman, Tel-Aviv Sourasky Medical Center, Israel

**O.16.2 Foot plantar vibration does not improve postural control in young healthy people after plantar ice immersion:** Chich- Haung Yang, Tzu-Chi University, Taiwan

**O.16.3 Functional characteristics of spinal motoneurons in rat and monkey those acquired bipedal locomotor capability:** Futoshi Mori, Yamaguchi University, Japan

*(Hisho B)*

15:15-16:15 **O.17 Oral Session: Modelling**

**Chair:** Joyce Fung, McGill University, Canada

**O.17.1 Leg stiffness increased with load to achieve resonant gait dynamics:** Sue Park, Kaist, South Korea

**O.17.2 Training teenagers with cerebral palsy on a split-belt treadmill: from kinetic adaptation to motor learning:** Simona Bar-Haim, Ben-Gurion University of the Negev, Israel

**O.17.3 Hip-ankle synergy in human biped balancing resulting from multisensory integration in feedback control:** Georg Hettich, University Freiburg, Germany

**O.17.4 Feedback control of balance muscle activity in individuals with Parkinson's disease before and after adapted tango rehabilitation:** J. Lucas McKay, Georgia Tech and Emory University, USA

*(Botan)*

16:15-17:15 **O.18 Oral Session: Vestibular Functions and Disorders**

**Chair:** Masahiko Yamamoto, Toho University, Japan

**O.18.1 Gait impairment in downbeat nystagmus syndrome:** Klaus Jahn, University of Munich, Germany

**O.18.2 Recalibration of vestibular afference for orientation and navigation:** Daina Sturnieks, Neuroscience Research, Australia

**O.18.3 Contrived management for suspected autoimmune inner ear disease with abnormal eye movement:** Mamoru Suzuki, Tokyo Medical University, Japan

**O.18.4 The association between impaired perception of verticality and cerebral white matter lesions in the elderly patients with orthostatic hypotension:** Mitsuhiro Aoki, Gifu University Graduate School of Medicine, Japan

*(Botan)*

17:15-18:30 **Closing Ceremony**

*(Hisho A)*

# Notes

# Keynote Speakers

**Alain Berthoz**
Collège de France/CNRS Paris, France

Alain Berthoz is Honorary Professor at the College de France, member of the French Academy of sciences and the Academy of Technologies, the Academia Europae, American Academy of Arts and Sciences, and other Academies (Belgium, Bulgaria).

He is an Engineer, and is an expert in Biomechanics, Psychology and Neurophysiologist. He is a world known specialist of the physiology of multi-sensory integration, spatial orientation, the vestibular system, the oculomotor system, locomotion, and spatial memory. He is currently cooperating, within European Projects and with robotics groups in Japan for bio-inspired robotics and humanoids. He is the author of more than 300 papers in International journals and the author of several books on these subject among which The Brain's Sense of movement, Harvard Univ Press (O. Jacob 1997), Emotion and Reason The cognitive foundations of decision making, Oxford Univ Press (O. Jacob 2000) and Simplexity Yale University Press (O. Jacob 2011 ).

**The neuro-cognitive control and development of gait in health and disease. Recent findings**

Locomotor trajectories are controlled by neurocognitive, anticipatory top-down mechanisms. I will review the following recent findings and theoretical views:

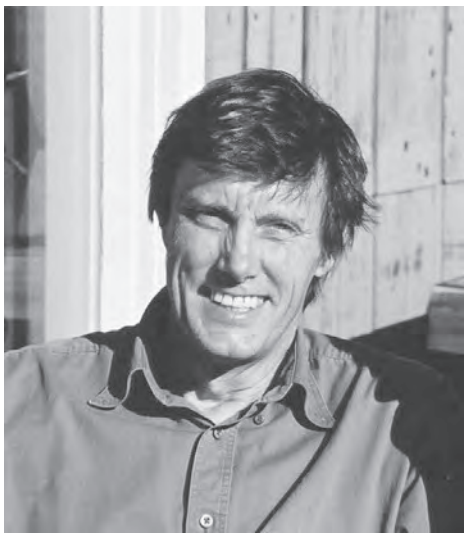
a) Similar "simplex" laws subserve hand and locomotor trajectory formation. We have shown that goal oriented locomotor are very stereotyped due to optimization principles. We have also shown a hierarchical top-down organisation with an anticipation of the locomotor trajectory by gaze. In addition we have shown that the brain uses for both hand movement and locomotor trajectory formation combinations of several geometries (Euclidian, affine, equi-affine).

b) Emotion does modify this organisation of gait.

c) The generation of locomotor trajectories uses brain mechanisms underlying spatial memory and navigation. Several different brain subsystems are involved in the control of trajectories to near space, far space or environment space. In addition these brain mechanisms involve different networks for egocentric or allocentric coding of navigation including the hippocampus, parahippocampus, retrosplenial cortex, cerebellum. I will show recent fMRI and virtual reality experiment demonstrating lateralization. The left and right hippocampus are involved in respectively sequential egocentric and global allocentric control of navigation. I will also allude to the role of the vestibular system in navigation.

d) New experimental paradigms, the "walking Corsi" and the "Magic carpet", " the "Walking Stroop" paradigms allow the study of cognitive strategies for the organisation of locomotor trajectory formation and visuo-spatial memory. We have used them to demonstrate the role of gaze in planning locomotor trajectories, and the development of locomotor trajectory formation in children and adolescents. I will also show some recent results concerning children patients with Cerebral Palsy, and aging persons with Mild Cognitive Disorders.

e) I will also briefly show how these findings can inspire the design of Humanoid Robots.



**Keir Pearson**
University of Alberta, Canada

Keir Pearson is a neurophysiologist who received his Bachelor of Engineering (Electrical) from the University of Tasmania and his PhD in Physiology from Oxford University. He is currently an Emeritus Professor in the Department of Physiology at the University of Alberta, Canada, and former Director of the University Centre for Neuroscience. He has held a Tier I Canada Research Chair in Movement Physiology and he is a Fellow of the Royal Society of Canada. His research program is focused on the nervous control of walking, with special interest in the role of vision and memory in guiding stepping movements.

**Working memory for obstacle avoidance during walking**

Stepping over an obstacle during walking usually relies on visual information about the location of the obstacle relative to the body. However, visual fixation of the obstacle is not necessary at the time the legs move to avoid the obstacle. For example, quadrupeds and humans often view the terrain two or three steps ahead of their current position, and store visual information about target locations in working memory to guide leg movements at a later time. In quadrupeds, a unique form of working memory is used to guide the hind legs over obstacles that have already been stepped over by the forelegs. This working memory is very long-lasting (many minutes) and incorporates precise information about the size and position of the obstacle relative to the hind legs. I will present data from electrophysiological and lesion studies that demonstrate that neuronal systems in the parietal cortex are necessary for establishing this memory and for representing the current position of the obstacle relative to the moving body. The lesion studies also indicate that these representations in the parietal cortex are used specifically to retain long-lasting memories (up to minutes) of obstacle location, and that short-lasting memories (up to a few seconds) are represented in other brain regions. I will present the hypothesis that remapping of obstacle location relative to the moving body depends in part on sequential activation of different populations of neurons in parietal cortex, with each population representing the specific location of the obstacle relative to the position of the legs. These and other observations will be discussed within the concept of a body schema, that is, how a representation of body geometry is used and updated to control motor commands as an animal interacts with the external world.

# Keynote Speakers

**Marianne Dieterich**
Ludwig-Maximilians-University of Munich, Germany

Prof. Dr. med. Marianne Dieterich, is Head of the Department of Neurology, Ludwig-Maximilians-University, Klinikum Grosshadern, Germany. She is a former Research Fellow with the Primate Laboratory of the Vestibular Laboratory, Dept. of Neurology, Kantonsspital Zürich, Switzerland. She has also worked with the Alfried Krupp Hospital Essen, the Universities of Bochum and Essen, and Johannes Gutenberg-University Mainz, Germany.

In 2013 she was honored with the 'Designation of Corresponding Fellow of the American Neurological Association (FANA)' and in 2011 was awarded the 'Award of the German Society of Clinical Neurophysiology and Functional Imaging (DGKN) for outstanding teaching'.

**Functional imaging of vestibular disorders with implications for rehabilitation**

The last 15 years have brought new insights into the vestibular system thanks to lesion studies and functional imaging of the human brain. The latter technology was at first applied only to healthy subjects but now it is being more often used with patients who have diseases localized to the vestibular system, so-called vestibular disorders. The groundwork for such investigations was provided by neurophysiological and tracer animal studies in the 1970s to the 1990s. These studies located several areas in the cerebral cortex, especially in the tempo-ro-parietal cortex, that formed a sort of network. All of these areas showed multisensory reactions, not only to postural stimuli but also to stimuli of the visual and sensory systems. The center of this network was located in the parieto-insular vestibular cortex, the PIVC. Today, owing primarily to the findings of functional imaging studies, we know that such a network also exists in the human temporo-parietal cortex of both hemispheres. Moreover, this human network has a number of particular features. For example, the "activation" of the network in healthy subjects is not equally distributed in the two halves of the brain; while the right hemisphere is predominant in right-handers, the left hemisphere is predominant in left-handers. The side stimulated also plays a role: activation is more strongly pronounced in that half of the brain that is on the same side as the stimulated ear. In addition to such activations we know there are simultaneous "deactivations" that are localized in the visual and somatosensory cortices of both brain halves during vestibular stimulation. A complementary activation-de-activation pattern was observed during visual stimulation: activations in the occipital and parietal visual areas occurred simultaneously with deactivations in the multisensory vestibular cortex. These observations led to the hypothesis of the existence of a reciprocal inhibitory interaction between the two sensory systems of the cortex, i.e., between the visual and the vestibular systems. The data from brain activation studies of the vestibular system in healthy subjects can now be compared with the data of patients with various peripheral and central vestibular disorders in the acute stage of disease and lateron during compensation. Such comparisons promise to deepen our understanding of these syndromes, will have implications for rehabilitation and thus will speed the development of new therapies for these disorders.

**Stephen Robinovitch**
Simon Fraser University, Canada

Stephen Robinovitch, Ph.D., is a Professor and Canada Research Chair at Simon Fraser University in Vancouver, Canada. His research focuses on the cause and prevention of falls and fall-related injuries in older adults, and incorporates biomechanics, neurophysiology, and clinical research methods. He currently leads a program in "Technology for Injury Prevention in Seniors" (www.sfu.ca/TIPS), involving long-term care facilities who participate as "real life" laboratories for capturing objective evidence of falls (through video and wearable sensors), and exploring the clinical effectiveness of engineering interventions such as wearable hip protectors and compliant flooring for preventing fall-related injuries.

**Protective responses in older adults for avoiding injury during falls**

Over 30% of older adults living independently, and 60% of those in long-term care (LTC) fall at least once each year. Any fall from standing onto a firm surface has the potential to cause life-threatening brain injury, and carries 20 times the energy required to fracture the elderly proximal femur. It is therefore not surprising that falls are the number one cause of injuries, including 95% of hip fractures and 60% of traumatic brain injuries, in older adults. Indeed, a more perplexing issue is the observation that most falls in older adults are benign events: only 10-15% result in some form of injury, and only 1-2% cause hip fracture or head injury. Understanding the factors that separate injurious and non-injurious falls is essential to developing improved approaches to fall injury prevention. In this talk, I will review evidence of the crucial role of "safe landing responses" for avoiding injury during falls, derived from laboratory experiments and field studies involving video capture of real-life falls in LTC. I will also discuss how these responses are altered through the lifespan, and how they may be enhanced through interventions. Specific topics to be discussed include: (1) "Factor of risk" for injury: the energy management problem of falls; (2) Lessons from epidemiology on falling behaviours: effect of age, functional status, and wearable hip protectors on injury patterns during falls; (3) Video-captured evidence of strategies by older adults for avoiding impact to the head and hip, and reducing impact velocity during falls; (4) The effect of disease and functional status on fall severity in older adults. The talk should be of interest to both researchers and care providers interested in the prevention of fall-related injuries in older adults.

# Keynote Speakers

**Jeffrey Hausdorff**
Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Israel

Dr. Jeffrey M. Hausdorff is the Director of the Laboratory for the Analysis of Gait and Neurodynamics at Tel-Aviv Sourasky Medical Center, Professor at the Sackler School of Medicine and Sakol School of Neuroscience, and Lecturer in Medicine at Harvard Medical School. With a background in biomedical engineering and a strong interest in wearable computing, Dr. Hausdorff studies gait and postural control, fractal physiology, gait variability, motor control, and brain function. Recent investigations focus on imaging and the genetics of gait alterations, the potential of virtual reality to improve motor-cognitive interactions, and new methods for assessing and minimizing fall risk.

**What happens when body-fixed sensors meet Parkinsonian gait? A look back to the future**

For about two decades now, researchers have been studying the walking pattern of patients with Parkinson's disease using body-fixed sensors. The understanding of gait dynamics in Parkinson's disease evolved over this period. It has been shown that certain features of the stride-to-stride fluctuations in gait are related to disease severity and that some properties respond to dopamine and other therapeutic interventions. Associations between measures of gait dynamics and specific aspects of cognitive function have also been uncovered. Insights into the perplexing and debilitating episodic phenomenon known as freezing of gait have been achieved, along with intriguing observations on the relationship between genetic mutations common in Parkinson's disease and specific alterations in gait dynamics.

In parallel, the sensors and algorithms that have been used to evaluate gait dynamics in Parkinson's disease and related disorders have also evolved. Today, the traditional clinical examination of Parkinson's disease can be augmented by instrumenting clinical tests like the Timed Up and Go with small, easy-to-use body-fixed sensors. The combination of these inertial measurement units and new technology like wireless functional near infrared spectroscopy (fNIRS) and virtual reality also hold promise for providing a new window into the control and treatment of gait dynamics. At the same time, the clinical exam is expanding outside the walls of the clinic. The assessment of gait dynamics during community ambulation will further enhance our understanding of both the continuous and the episodic gait disturbances in Parkinson's disease, the disabling motor response fluctuations, and fall risk.

This lecture will take us on a brief tour of some of the advances made over the past twenty years in Parkinson's disease and related populations and speculate about where we are headed toward in the future.

## **Symposium IX:** Sunday June 23, 13:00 - 15:00, Botan

## Balance And Gait Disorders: A Symptom-Based Approach

Chair: **Bastiaan R. Bloem**, Radboud University Nijmegen Medical Center, The Netherlands

Chair: **Yasuyuki Okuma**, Juntendo University Shizuoka Hospital, Japan

Careful recognition of neurological gait and balance disorders is very important in everyday clinical practice, for a variety of reasons. First, gait and balance disorders impose significant disability for affected individuals. Second, difficulties with walking and maintaining balance force patients to reduce their physical activities, and physical inactivity is in turn associated with a host of negative consequences, including a worsening of disease symptoms, development of osteoporosis, sleep disorders, and a reduced survival. Third, specific features of gait and balance can offer important diagnostic clues in patients with an uncertain clinical diagnosis. Importantly, changes in gait typically develop early on in the course of many neurological disorders. To improve the clinical recognition of gait and balance disorders, several classification schemes have been proposed. In case of gait disorders, it is a common approach to define the type of gait disorder according to the main presenting feature (1,2). Examples include an ataxic gait, a dystonic gait, or a waddling gait. The typical way of teaching students and residents about such gait disorders is to present a typical phenotype, and to list all the possible features associated with this specific type of neurological gait disorder. However, this is not the way patients usually present to the doctor in clinical practice. Indeed, patients may display only one or at most a few abnormal gait or balance signs, and some of these may fit with different types of neurological disorders. In my presentation, I will offer a new approach to disorders of gait, balance and posture, taking typical presenting features as the starting point for recognising the associated neurological syndrome, and for building a differential diagnosis.

### A weak balance, balance and falls in patients with neuromuscular disorders

**Corinne Horlings, B.G.M. van Engelen**, B.R. Bloem, Radboud University Medical Center, The Netherlands

Both the central and peripheral nervous system contribute to balance control. For studying the influence of the peripheral nervous system on balance control mechanisms, one can examine balance in patients with specific neurological disorders, such as sensory ataxia (due to sensory loss in e.g. patients with polyneuropathy) or muscle weakness. However, in patients with neuromuscular disorders balance is hitherto poorly studied. Even though muscle weakness is an important risk factor for falls, as was shown in the elderly. In patients with neuromuscular disorders, falls are common and clinically relevant. This was shown in patients with fascioscapular humeral disease, who have weakness in both distal and proximal muscles. In a prospective 3 month follow-up, 47% of these patients reported a fall, and injuries occurred in almost 70% of the patients. We also examined the influence of distal versus proximal muscle weakness on balance control, by measuring balance reactions that were probed using sudden platform tilts in different directions in patients with pure distal muscle weakness versus proximal weakness. Here, distal weakness caused greater centre of mass (COM) instability than proximal weakness, and mainly in the pitch plane. Patients with distal weakness also reported greater fall frequency retrospectively. Compensation strategies consisted of increased knee movements and arm movements, which in distal weakness patients were only partly effective. Future studies should focus on formulating muscle weakness thresholds and correlating these with COM instability in order to predict fall risk. Perhaps, rehabilitation for these patients should focus on enhancing compensation strategies in order to prevent falls.

### Freezing of gait in Parkinson's disease

**Yasuyuki Okuma**, Juntendo University Shizuoka Hospital, Japan

Freezing of gait (FOG) is a common and very disabling symptom in Parkinson's disease (PD). It is usually observed in the advanced stage of the disease, although a mild form can be seen in the early stage. FOG occurs more frequently in the off-state than in the on-state. The mechanism underlying the pathogenesis of FOG include sequence effect of a progressive shortening of step length owing to deficient internal driving, impaired automaticity, impaired gait rhythmicity and gait cycle coordination, perceptual malfunction, and frontal executive dysfunction. FOG is considered a result of these multiple gait impairments. Modulation of gait coordination by lateralized (asymmetric) subthalamic stimulation may improve FOG. Walking-through-the-doorway tasks are used to study perceptual malfunction, suggesting that responses to action-relevant visual information are exaggerated in PD with FOG. Falls are also a significant problem in PD patients. FOG is the most common cause of falls in advanced-stage PD patients, particularly in the off-state and transition-state between on and off. Our attempt to objectively evaluate FOG and falls in everyday life using a triaxial accelerometer will be presented.

### Imaging and physiological approaches to gait and postural disturbance in Parkinson's disease and related disorders

**Takashi Hanakawa**, Integrative Brain Imaging Center, National Center of Neurology and Psychiatry, Kodaira, Japan and PRESTO, Japan Science and Technology Agency, Kawaguchi, Japan

The mechanisms of how the central nervous system controls walking and standing remain unclear in humans. The lack of this knowledge makes it difficult to understand the pathophysiology underlying hypokinetic/akinetic-type gait disturbance in patients with Parkinson's disease (PD) and related disorders. Using single-photon emission computed tomography (SPECT), we have demonstrated that gait disturbance is associated with hypofunction of supplementary motor areas (SMA) in PD (Hanakawa et al. Brain 1999) and in patients with ischemic white matter changes (Iseki et al. Neuroimage 2010). Activity in the lateral premotor cortex was negatively correlated with gait disturbance (Iseki et al. Neuroimage 2010). This premotor overactivity was consistent with our previous study in which the premotor cortex showed compensatory activity during paradoxical improvement of gait in PD (Hanakawa et al. Ann Neurol 1999). The roles of SMA and premotor cortex in gait control are also supported by brain activity during planning of gait. Namely, SMA and premotor cortex are active during mental imagery of gait, which is supposed to share mechanisms with planning of actual gait (Iseki et al. Neuroimage 2008). An analysis of diffusion tensor images (DTI) with tract-based spatial statistics indicated that patients with freezing of gait (FOG) had reduced integrity of the white matter beneath the premotor areas (Iseki et al., in preparation). These results consistently support the roles of SMA and premotor cortex underlying control of walking. Patients with PD show abnormal posture during standing, such as camptocormia. To clarify its pathophysiological mechanisms, we have started to investigate muscle activity in the abdominal and trunk muscles on a tilt table (Furusawa et al. 2nd Joint World Congress of ISPGR and Gait and Mental Function). We have found evidence indicating that abnormal muscle activity in the external oblique muscle of the abdomen may trigger the abnormal posture. It would be interesting to examine neural activity in the central nervous system responsible for this phenomenon. Future integration of basic neurophysiology, clinical, and imaging studies will advance the understanding of control mechanisms of gait, and enhance the understanding of pathophysiology of hypokinetic/akinetic gait and postural abnormality.

## **Symposium I:** Monday June 24, 10:00 - 12:00, Hisho A

# Advanced Technologies to Enhance Sensorimotor Integration in Postural Control

Chair: **Joyce Fung,** McGill University, Canada

### A mixed reality system for sensorimotor rehabilitation

**Joyce Fung**, McGill University, Canada

BACKGROUND AND AIM: In the control of upright balance, the central nervous system has to generate task-specific and goal-directed motor responses based on the selective and rapid integration of sensory information from multiple sources. Loss of upright balance control resulting in falls occurs frequently post stroke. Postural imbalance may arise not only from motor or sensory impairments but also from the inability to select and reweight pertinent sensory information. Virtual reality (VR) technology provides the opportunity to manipulate sensory, perceptual and cognitive information to optimize motor learning. METHODS: A servo-controlled, self-paced treadmill is mounted on a 6-degree-of-freedom motion platform to simulate sudden or gradual terrain changes. Subjects walk in a virtual environment (VE) that presents challenges related to physical (obstruction and surface angle), temporal (speed requirements to avoid collision with moving obstacles) and cognitive (attention, planning) domains. Subjects also walk with a leash in hand with haptic forces controlled in 3D by a robotic device (Haptic Master). Postural reactions and adaptations during walking are assessed by comparing body kinematics and centre of mass (CoM) trajectories between healthy and post stroke individuals. RESULTS: Persons with stroke generally have difficulty coordinating and stabilizing their body movements when they were first exposed to walking in the VE, as evidenced by their CoM excursions which show less coordination and lack the smooth multiphasic control observed in healthy subjects. However, postural adaptations occurred after repeated exposures and the improvements were retained by training. Increased forward haptic forces result in increased gait velocity and decreased COM excursions, indicating increased postural stability. CONCLUSIONS: A mixed reality system incorporating VR, surface perturbations and augmented haptic input can be utilized for balance and gait rehabilitation post stroke. Balance and gait stability can be improved with repeated practice and training with enhanced somatosensory inputs.

### Using Virtual Reality for cross-modal adaptation of whole-body postural control

**W. Geoffrey Wright**, Temple University, USA

BACKGROUND AND AIM: Sensori- and visuo-motor adaptation has been shown in many forms over the last century. For example, VOR can be directionally recalibrated by prolonged pairing of optic flow with an inertial input that is different than would normally occur (i.e. cross-axis adaptation). Adaptation can also be induced when reaching while wearing prism goggles. After a short period of visually-guided reaching, endpoint errors disappear. But evidence of the visuo-motor adaptation can be seen by aftereffects; when the goggles are removed reaching errors occur in the opposite direction. These adaptations may also be retained over long periods of time, since repeated-exposure may induce fast context-specific adaptation that can be recalled quickly when goggles are donned again. The current study investigates adaptation to discordant visual-inertial input to determine 1) whether virtual environments (VE) can be used to induce whole-body postural adaptation, 2) what spatial and temporal characteristics of the stimulation may affect adaptation, and 3) whether adaptation can be retained. METHODS: Pilot testing (n=8) involved a 6 min period of adaptation during which subjects viewed a VE scene depicting 5m of sinusoidal A/P translation while standing on a surface translating sinusoidally along the M/L axis (left/right: ±10cm) with frequency matched to that of the VE scene (0.2 Hz). After adaptation, COP aftereffects were measured by removing sinusoidal M/L surface input, but continuing A/P sinusoidal optic flow. RESULTS: During adaptation, the A/P optic flow entrained COP in the A/P direction while M/L

COP became entrained with M/L sinusoidal surface motion. The postural response adapted to this combined motion during exposure, i.e. cross-modal adaptation, which was evident in the postural aftereffects. The axis of COP sway was ~45° between the A/P and M/L axes if subjects viewed only A/P optic flow without M/L surface input. A sine fit regression at the 0.2 Hz driving frequency showed a significant increase in sinusoidal M/L COP sway ($p<0.05$) and a significant increase in power spectral density at 0.2 Hz. Nonlinear analysis revealed highly significant differences between A/P and M/L COP pre- and post-adaptation ($p<0.001$). The aftereffect had largely decayed within a few minutes. CONCLUSIONS: After cross-modal adaptation, sensorimotor recalibration ensures postural stability is controlled in the new sensory environment. Nonlinear changes in COP complexity reflect CNS dynamics that drive the sensorimotor integration process to reduce error signals caused by discordant sensory stimuli. Our next experiment will use repeated exposure to cross-modal stimulation to determine if adaptation can be induced more quickly and retained for longer periods. If this experimental paradigm can be used to adapt the sensorimotor system towards a more optimal state, then this would be beneficial outside of the VE (e.g. in rehabilitation interventions).

**Technology enhanced sensorimotor integration supports training of postural performance**

**Emily Keshner**, Temple University, USA

BACKGROUND AND AIM: The human balance system relies on multimodal sensory inputs, and the integration of concurrent sensory information with expected sensory consequences. Conflict between sensory signals requires an ability to identify the mismatch, and select an appropriate response. A reduced ability to detect or compensate for this sensory conflict may contribute to the increased incidence of falls during multitasking. Adding noise to a biologic system has been shown to enhance the detection and transmission of weakened or sub-threshold cutaneous signals. It was hypothesized that augmenting proprioceptive information through vibrotactile stimuli would reduce the impact of a visual/vestibular mismatch on postural behavior. METHODS Sub-threshold vibration noise was applied at the soles of the feet in 21 healthy adults (20-29 yrs) standing quietly and performing a mental calculation task on a compliant surface. For both tasks, subjects viewed a virtual scene referenced to their head motion or rotated in upward pitch at 30 deg/sec. An ellipse fit to the covariance matrix revealed excursion of center of pressure (COP) and center of mass (COM) responses in frontal and sagittal planes. RMS values and approximate entropy of the COP and COM were calculated and statistically compared. A training paradigm used sub-threshold vibratory noise applied to the plantar surface of the feet can alter postural behaviors in 5 adults with stroke (39-67 yrs) standing in the dark on a sway referenced support surface. Before, immediately after, and two weeks following this training, postural responses of adults with stroke were assessed in a virtual environment. Pitch upward and downward rotations of the visual field were combined with the sway-referenced support surface. RMS and power spectral density of the COP was calculated. RESULTS: Postural sway was increased with both visual field rotations and mental calculation in a head referenced visual field. Adding mental calculation to visual field rotations, however, decreased postural sway. Adding vibration decreased the area of COM motion and increased regularity of both the COP and COM. COM and COP responses were larger during and after vibration suggesting that both the stabilizing effect of a head-referenced visual field and the destabilizing effect of visual rotation decreased with the administration of vibration. Immediately after and 2 weeks post-training, COP magnitude was decreased and frequency content of the response was more complex than prior to training. CONCLUSIONS: Results suggest that sub-threshold vibrotactile stimulation produced significant effects on the human balance system in environmental conditions that generated increased postural instability. The addition of vibrotactile stimulation modified the direction and regularity of the sway response supporting its use as an adjunct to interventions for impaired balance.

**Functional near-infrared spectroscopy as an evaluation and possible training tool for postural control and balance**

**Masahito Mihara**, Osaka University, Japan

BACKGROUND AND AIM: Postural control requires complex visuo-sensorimotor coordination, and previous animal studies have revealed that multiple CNS structures, including the spinal cord, brainstem, cerebellum, basal ganglia, and cerebral cortex, regulate the autonomic and voluntary control of posture and gait in a hierarchical manner. However, human bipedal posture and gait are unstable in nature, and presumably, the cortical contribution is much more important in humans than in quadruped animals. Functional near-infrared spectroscopy (NIRS) could enable us to measure cortical activation during dynamic movements, including gait and postural maintenance, and provide novel insight into the neural mechanism underlying gait and postural control in humans. METHODS: To investigate the cortical activation associated with the maintenance of upright posture in healthy subjects, we applied external postural perturbation by using combined brisk sliding of a platform for 4 cm. We also investigated the correlation between individual balance ability and regional cortical activation (cross-sectional study) as well as longitudinal cortical activation changes and correlation between balance recovery and cortical activation changes (longitudinal study) in post-stroke hemiplegic patients. RESULTS: In healthy subjects, both prefrontal cortices were activated on postural perturbation. A foregoing warning cue provided 2 s before perturbation could enhance the postural perturbation-related cortical activation in the supplementary motor area (SMA) and the posterior association cortex. In post-stroke patients, the SMA activity was correlated with individual balance ability and balance recovery after stroke. CONCLUSIONS: These results indicated that the SMA and posterior association cortex might play important roles in intentional postural maintenance in healthy subjects. Additionally, both cross-sectional and longitudinal study revealed that the SMA was one of the crucial cortical area for balance recovery after stroke. FUTURE DIRECTIONS: In addition to providing unique advantages as a neuroimaging tool for investigating neuronal mechanisms underlying balance and postural control, functional NIRS could be applied as a treatment tool for enhancing motor function or functional recovery. Recently, we have reported the potential usefulness of functional NIRS-mediated neurofeedback as a novel non-invasive neuromodulation technique. A combination of neurofeedback provided using a functional NIRS system and mental practice with motor imagery could enhance the motor imagery-related cortical activation and could augment the recovery of hand movement after hemiplegic stroke. Using similar neurofeedback techniques, we are trying to investigate the therapeutic effect of functional NIRS-mediated neurofeedback on the balance and postural ability in healthy subjects and patients with neurological diseases.

## **Symposium II:** Monday June 24, 10:00 - 12:00, Hisho B

## Physical Activity Monitoring With Focus On Physical Behaviour

Chair: **Jorunn L. Helbostad,** Norwegian University of Science and Technology, Norway

Measurement of free-living physical behaviour by use of activity monitors has typically focused on intensity and energy expenditure and their relation to health variables. Another option is to describe physical behaviour in term of postures, transitions and activities that are actually performed, like lying, sitting, standing, walking and transitions between sitting and standing. Such events can be expressed as total time or numbers of events or patterns of activity. More knowledge about different outcomes of activity events can give insight to the role of patterns of daily physical behaviour on functioning in daily life. In the symposium a framework for measurement of physical behaviour by use of activity monitoring will be presented and discussed. Different methods to describe activity patterns will be presented in addition to data on physical behaviour patterns in healthy populations and elderly patient populations.

### Event-based analysis of Physical Behaviour: Application in patients with Intermittent Claudication

**Malcolm Granat**, Caledonian University, Scotland

It has been shown that event-based analysis of physical activity and sedentary behaviour can provide a flexible and yet robust method of producing relevant outcome measures addressing specific clinical, or public health, research questions. The quantification of the patterning of these events can be considered as a direct measure of the physical behaviour of interest. This approach can be illustrated in patients with Intermittent Claudication who report they have to stop regularly whilst walking due to ischaemic pain. Event-based analysis of these walking events can produce clinically-relevant outcomes reflecting symptom severity and its impact on mobility and physical behaviour. These outcomes provide an objective patient-centred measure of disease severity and efficacy of intervention. This flexibility of this approach makes this technique applicable across a wide range of different research constructs.

### Physical activity as a dynamical behaviour. - A new paradigm

**Sebastien Chastin**, Caledonian University, Scotland

Influencing behaviour to enabling and encouraging individuals to maintain and increase their physical activity is a major goal of rehabilitation and public health. This requires that we understand physical activity behaviour and how individuals construct their activity pattern. Currently physical activity is defined as movement leading to energy expenditure. Therefore, energy expenditure and total amount of activity are the principle measurands and outcomes studied and reported. Little attention has been paid to the analysis of patterns of physical activity. Patterns of physical activity are a direct reflection of behaviour and the human decision making process and how people are active; "when people decide to do what". Advances in technology, now enable us to track physical activity patterns over long periods and with great details. The availability of such intensive data logging different domains of physical behaviours will increase rapidly in the future. This is an opportunity to further understand physical activity, but it requires a change in paradigm and an alternative definition of physical activity as behaviour leading to movement and in turn energy expenditure should be adopted. Time series of recorded events enables us to analyse and study the dynamics and diversity of behaviour. We will present clinical examples that illustrate the benefits, technical and analytical challenges of a dynamical approach to the analysis of physical activity data.

### Physical behaviour and function in older persons after hip fracture

**Kristin Taraldsen**, Norwegian University of Science and Technology, Norway

Each year 9000 persons experience a hip fracture in Norway. Hip fractures are associated with high morbidity and mortality, and few regain their pre-fracture function. Older adults with hip fractures represent a large group of older persons with mobility limitations. So far, the only available knowledge about physical activity comes from questionnaires. Because most physical activity in these frail older people is through low-intensity every-day life activities, more knowledge about physical behaviour in real life settings in daily life is needed. Knowledge about physical behaviour may help us understand more about factors contributing to explaining lack of return in pre-fracture function, as well as giving us more information about effects of different treatment approaches. Results from an RCT designed to assess the effect of a geriatric comprehensive assessment and intervention compared to treatment in an orthopaedic ward will be presented. Results on physical behaviour described as length of bouts of activity and activity pattern through the day will be presented. Data on physical behaviour will be compared to outcomes of physical function the 5th day after surgery, and 4 and 12 months after surgery.

**The relationship of fatigue with patterns of daily physical behaviour among older adults**

**Thorlene Egerton**, Norwegian University of Science and Technology, Norway

Fatigue is one of the most common reasons given by community-dwelling older people for activity restriction and is a frequently reported as a cause of disability. Not all fatigue among the elderly can be explained by the higher levels of co-morbidities and poly-pharmacy with increased age. Non-specific, self-reported fatigue may be related to an accelerated aging process. Fatigue may be the first sign to emerge of the frailty syndrome, and may therefore be present before the onset of consequent disability and morbidity. In contrast to persistent, non-specific feelings of fatigue, fatigue following physical or other types of activity is to some degree a normal experience. If, however, the level of fatigue experienced after activity relative to the amount of activity performed is exaggerated, it may also be disabling. Activity-related fatigue has been termed 'fatigability', and is a function of de-conditioning as well as the ageing process. Higher levels of both self-reported non-specific fatigue and fatigability may lead to changes in temporal characteristics of physical activity behaviours as well as total amounts of physical activity. Physical activity behaviour quantification can lead to a deeper understanding of problems and their consequences. Data will be presented on the associations between self-reported, non-specific fatigue and fatigability with temporal patterns of daily physical behaviour of 70-75 year olds.

## **Symposium III:** Monday June 24, 10:00 - 12:00, Botan

## Disturbances of posture, gait, and space orientation by vestibular dysfunction

Chair: **Toshihisa Murofushi**, Teikyo University School of Medicine, Mizonokuchi Hospital, Japan

We maintain our body balance by integrating vestibular, proprioceptive, and visual information in the central nervous system (CNS). Therefore, dysfunction of the vestibular system including CNS leads to disturbances of posture, gait and space orientation. In this symposium speakers present how peripheral and central vestibular dysfunction affects posture, gait, and space orientation from various viewpoints. Dr. Omi will talk about gait analysis using tactile sensor in vertigo and vestibulospinal tract disorders. His talk will include analyses of patients with central nervous system disorders as well as peripheral vestibular disorders. Dr. Fujimoto will talk about contribution of vestibular dysfunction to postural disorders in the elderly. In postural disorders of the elderly vestibular dysfunction plays an important role. He will talk about both aspects of diseases in the elderly and aging-related dysfunction. Dr, Young will talk about animal study of vestibular-evoked myogenic potentials. Vestibular evoked myogenic potential (VEMP) is one of useful clinical tests of the otolithic system. For better understanding of this test, animal experiments are important. I will talk about disorders of space orientation due to vestibular dysfunction, especially dysfunction of the otolithic organs, sensors of linear acceleration. Because the otolithic organs sense translation and tilt, dysfunction of these organs seems to lead to illusion of tilt and linear movement. I will present dysfunction of the otolithic organs could cause this type of illusion using VEMP. In our study patients with illusion in the roll plane showed tendency of abnormal responses in oVEMP testing, which is a test of the utricle. On the other hand, patients with illusion in the pitch plane showed tendency of abnormal responses in cVEMP testing. On the basis of our findings, I will propose a new clinical entity, idiopathic otolithic vertigo.

### Gait Analysis using Tactile Sensor in Vertigo and Vestibulospinal Tract Disorders

**E. Omi**, Akita University, Japan

Background and aim: Normal gait can only be achieved by systematic integration of normal equilibrium function, space orientation and cognitive function. However, unilateral vestibular disorders such as vestibular neuritis and acoustic tumor, cause defect of space orientation and lead to abnormal gait. To understand, physiologically, how vestibular disorder might affect the stability of gait, normal individuals and patients with various types of vestibular lesion were studied by means of gait analysis using tactile sensors. Methods: 23 normal individuals, 14 vestibular neuritis patients, 61 acoustic tumor patients, 12 spino-cerebellar-degeneration (SCD) patients were enrolled and gait analysis using of tactile sensors installed under both feet were performed. Mean time length and coefficient of variation (CVs) of stance, swing and double support were analyzed as gait phase-related parameters. In addition, stability of foot pressure progression and trajectories of center of force were also be analyzed. Comparison of means were made using the two-tails t-test, with $p<0.05$ as the criterion for statistical significance. Results: Gait instability is depicted by increment of coefficient of variation of each gait phase. Visual cue plays an important role providing feed forward information for steady locomotion. Unilateral vestibular lesion could shift body center of gravity toward the lesion side, which leads greater foot pressure on the lesion side foot with greater horizontal sway of TCOF during gait, especially under gait with eyes closed. Irregular pattern of foot pressure progression could also reflect gait instability, and the greatest was found in SCD. As for the average length of TCOF, significantly longer trajectories were found especially when compared to vestibular neuritis. Conclusions: Vestibular inputs play an important role in the regulation of gait phase. However, gait is in some cases seemed to be normal despite of vestibular dysfunction due to the compensation by visual inputs. In conclusion, gait analysis by the use of foot pressure sensor could provide useful information for the understanding of gait abnormality caused by vestibular disorders. It is desirable to perform the gait test for evaluation of gait abnormality with vertigo patients.

### Animal study of vestibular-evoked myogenic potentials

**Y.H. Young**, Taiwan University, Taiwan

Aim: The otolithic organs, utricle and saccule, respond to linear acceleration and gravity, serving as a functional role in maintaining postural stability. Recently emerging ocular and cervical vestibular evoked myogenic potential (oVEMP and cVEMP) tests expand the test battery for clinicians to assess the dynamic utricular and saccular functions, respectively. This study applied the oVEMP and cVEMP tests to guinea pigs coupled with morphological examination to study the pathophysiology of otolithic disorders in guinea pigs. Method: Ten healthy and 10 gentamicin-treated guinea pigs were enrolled. An amount of 0.05 mL of gentamicin (40 mg/mL) was directly dropped onto the round window membrane of the left ear. After two weeks, all animals underwent oVEMP and cVEMP tests. The oVEMP test was elicited via a hand-held bone-conducted vibrator placed on the animal's forehead at the stimulus intensity of 139 dB force level (FL). The cVEMP test was conducted using click stimuli (120dBSPL) generated by an earphone connected via a short tube inserted into the ear canal. Having finished the VEMP testing, all the animals were sacrificed for morphological study. Results: All 10 healthy guinea pigs exhibited clear oVEMPs, with the mean nI latency, pI latency and nI-pI amplitude of oVEMPs were 3.21±0.39 ms, 4.80±0.29 ms, and 67.3 ±47.8 ìV, respectively. Similarly, all healthy animals showed clear cVEMPs, with the mean positive peak I latency, negative peak II latency, and amplitude I-II of cVEMPs of 6.41±0.78 ms, 7.42±0.52 ms, and 5.75±1.95ìV, respectively. In contrast, none of the gentamicin-treated ears showed clear oVEMPs and cVEMPs. Morphological study of animals with absent oVEMPs and cVEMPs identified substantial damage to the utricular and saccular macula. Conclusion: The animal models of oVEMP and cVEMP in guinea pigs set the stage for studying the pathophysiology of otolithic disorders.

**Contribution of vestibular dysfunction to postural disorders in the elderly.**

**Chisato Fujimoto**, University of Tokyo, Japan

Posture in human beings is maintained by muscular actions under the control of the central nervous system. The processing of central nervous system organizes the information from vestibular, visual, and somatosensory inputs. Aging process declines in numerous sensory and motor functions and it is well known that postural stability decreases with age. In general, even though the peripheral vestibular function is damaged by vestibular disease, the prognosis of unsteadiness in the non-paroxysmal period is thought to be favorable when vestibular compensation is established. However, especially in the elderly, there are many cases that suffer from prolonged symptoms due to age-related changes associated with the postural control system, such as poor vestibular compensation and muscle weakness. Postural instability of the elderly with a vestibular dysfunction is considered to be influenced by not only functional impairment of the peripheral vestibular system due to vestibular disease but also age-related degenerative changes of the entire postural control system including the peripheral vestibular system.

**The vestibular contribution to spatial orientation in virtual and real environments**

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

Patients with complete vestibular deafferentation (BVF) show a gait disorder characterized by worsening in darkness and on uneven ground, oscillopsia during walking, and a speed dependency with particular impairment at slow gait velocity (Schniepp et al. 2011). It is less well known, however, that they also exhibit spatial orientation deficits. Patients with BVF after bilateral neurectomy show deficits in virtual spatial orientation tasks and have a reduced hippocampal volume (Brandt et al. 2005). Recent experiments have shown that BVF patients are not able to use an internal map to find shortcuts in a complex real environment. The latter experiments have been combined with functional neuroimaging (FDG-PET) with tracer injection during the navigational task. Further, subjects carried a head-camera throughout the experiment to document their visual exploration behaviour. Results show that patients with BVF have a significantly higher metabolism of the posterior parahippocampus whereas controls activate the anterior hippocampus. Analysis of visual exploration behaviour indicated a landmark-based navigation strategy in BVF. We performed a meta-analysis on central sensory contributions to locomotion and navigation and found support for the hypothesis that visual and vestibular pathways are partly separated in the hippocampal formation (Hüfner et al. 2011). Vestibular functions involve the anterior part of the hippocampus and entorhinal cortex; visual functions the posterior part of the parahippocampal gyrus. In general, it can be assumed, that the lack of vestibular information in patients impairs the construction of a spatial cognitive map via head direction and place cells in the hippocampus, which is compensated by visually-guided parahippocampal navigation. Brandt T, Schautzer F, Hamilton DA, Brüning R, Markowitsch HJ, Kalla R, Darlington C, Smith P, Strupp M (2005) Vestibular loss causes hippocampal atrophy and impaired spatial memory in humans. Brain 128: 2732-2741. Hüfner K, Strupp M, Smith P, Brandt T, Jahn K (2011) Spatial separation of visual and vestibular processing in the human hippocampal formation. Ann N Y Acad Sci 1233: 177-186. Schniepp R, Wuehr M, Neuhaesser M, Kamenova M, Dimitriadis K, Klopstock T, Strupp M, Brandt T, Jahn K (2012) Locomotion speed determines gait variability in cerebellar ataxia and vestibular failure. Mov Disorders 27: 125-131.

## Symposium IV: Wednesday June 26, 10:00 - 12:00, Hisho A

## Rehabilitation Update

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

Chair: **Prof. Futoshi Mori**, Yamaguchi Unviersity, Japan

**Locomotor Mobility following Traumatic Brain Injury**

**Bradford J. McFadyen**, Laval University, Canada

Locomotor mobility (LM) involves the coordination of different aptitudes across cognitive, psychosocial and motor domains. A Traumatic Brain Injury (TBI), regardless of severity, often affects LM at the core of all of these domains. While gait and postural control research for acquired brain injuries such as Stroke has received great attention, TBI research is still in its relative infancy. Yet, all ABIs can benefit from a more systemic understanding of mobility. This talk will address what is understood about LM following TBI and provoke discussion about where it should go to aid diagnoses, prognostication and intervention.

**Functional Electrical Stimulation for Restoration of Gait**

**Yoichi Shimada**, Akita University School of Medicine, Japan

BACKGROUND AND AIM: Restoring independence in performing daily functions is the main goal in treating paralytic patients. Recent advances in computer technology has made it possible to control paralyzed muscles by electrical stimulation. We have used functional electrical stimulation (FES) to restore the paralyzed muscles in the upper and lower extremities since 1990. Here we descibe the clinical application of FES in paralytic patients and evaluate the clinical results.

METHODS: Paraplegia for spinal cord injury and hemiplegia for stroke were participated in this research. Two type of electrodes, percutaneous intramuscular electrodes and surface electrodes have been used for stimulation of motor points in paralyzed muscles.

RESULTS: The hybrid-FES using percutaneous intramuscular electrodes provide practical ambulation in paraplegics. Although all paraplegic patients could stand and walk with hybrid FES using percutaneous intramuscular electrods, the clinical results of maximum duration of continuous standing and maximum distance of continuous walking were shown with the hybrid-orthosis using in daily living. The hemiplegic patients with intramuscular electrodes or surface electrodes could walk easily rather than Ankle-Foot Orthosis only. New FES system using surface electrodes, Bioness H300, was mostly effective and practical for restoration of hemiplegic gait.

CONCLUSIONS: FES was useful for restoration of gait in paraplegic or hemiplegic patients. In particularly, Bioness H300 FES system was strongly recommended for clinical use.

**Rehabilitation Update: Parkinson Disease**

**Gammon M. Earhart**, Washington University, USA

BACKGROUND AND AIM: This presentation will discuss rehabilitation in Parkinson disease (PD), with an emphasis on treatment of postural instability and gait disorders. The aims of the presentation are to discuss current practices in the rehabilitation for PD, review recent research in the field and the implications of this work for the future, highlighting areas where additional research is needed.

METHODS: A multimedia presentation will be used to illustrate current and emerging evidence supporting various approaches to PD rehabilitation.

RESULTS: As the importance of physical activity and exercise in the management of PD becomes increasing apparent, new models of PD care that incorporate rehabilitation from the earliest stages of the disease are emerging. This presentation will review recent evidence supporting pharmacology, surgery and exercise in the context of multidisciplinary rehabilitation for individuals with PD.

CONCLUSIONS: Participants will come away with a broad overview of the current state of rehabilitation for PD, knowledge of recent developments in the field and recognition of areas where additional research is needed.

**Vestibular PREHAB enhance recovery and long time postural performance after planned vestibular lesions.**

**Måns Magnusson**, Lund University, Sweden

An acute vestibular loss results in tonic and dynamic vestibular symptoms with behavioural consequences. Over time these symptoms weaken by action of central nervous compensation, that can be speeded up by vestibular rehabilitation. A simultaneous or previous central nervous disease may however, delay or impede compensation. In planned lesions as in schwannoma suregery or in vestibular ablation in incapacitating Menieres disease, the lesion can be forseen and planned. By introducing pre treatment with vestibular training before the lesion and separating lesion and thus compensation in time from the surgical trauma compensation can be achieved before f ex suregery This process we have named vestibular PREHAB.

We wanted to investigate whether pre-surgical deafferentation would affect post-surgery postural control also in a long-term perspective (6 months). Tot that end 41 patients subjected to trans-labyrinthine schwannoma surgery were divided into 4 groups depending on the vestibular activity before surgery (with no clinical significant remaining function n= 17; with remaining function n=8), whether signs of central lesions were present (n=10), and if patients with remaining vestibular activity were treated with gentamicin with the aim to produce uVD before surgery (n=6). The vibratory posturography recordings before surgery and at the follow-up 6 months after surgery were compared.

We found that the subjects pretreated with gentamicin had significantly less postural sway at the follow-up, both compared to the preoperative recordings and to the other groups.

By combined careful sensory training and separating the surgical trauma and the effects of uVD in time, can adaptive processes develop more efficiently to resolve sensory conflicts, not only resulting in a reduction of symptoms directly after surgery, but also persistent in the longer run and evident at least up to 6 month.

## Symposium V: Wednesday June 26, 10:00 - 12:00, Hisho B

## Visual dependency and balance control

Chair: **Adolfo Bronstein**, Imperial College London, England

From the point of view of controlling balance visual input is ambiguous as it can signal motion of the subject within the visual environment or motion of visual objects in relation to the subject. This ambiguity is partly resolved by inputs from inertial sensors such as the vestibular and proprioceptive systems. When signals from the inertial systems are unreliable, e.g. due to vestibular or proprioceptive lesions, subjects react excessively to motion of the visual surroundings. This has been documented with postural experiments with moving rooms or projected optic flow and psychophysically with the rod-and-disk test (which measures how much the subjective visual vertical is tilted by concurrent roll axis visual motion). Patients with vestibular disorders are highly sensitive to such visual stimuli but usually recover after the acute phase. However, some patients continue to exhibit enhanced responses to visual motion (so called enhanced visual dependency) and develop visually-induced dizziness (or visual vertigo; Guerraz et al; Brain 2001; 124:1646-56). Recent data will be presented showing that patients with migraineous vertigo have reduced adaptation to repeated visual motion stimulation, which may partly explain their dizzy symptoms (Agarwal et al; J Neurol 2012; 259: 1117-1124). Also, we will show that a laptop version of the rod-and-disk test to measure visual dependency in unselected vestibular neuritis patients can predict long term clinical outcome. Visual dependency is a maladaptive strategy which is detrimental to clinical recovery. Perceptual visuo-vestibular mechanisms, presumably cortical, participate in the long term recovery process after acute vestibular lesions.

### The effects of fear and anxiety on human balance control

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

Fear and anxiety are emotions that are commonly experienced by older adults and those with movement disorders. Strong associations between fear of falling and falls have been previously established, and a growing body of evidence supports a direct relationship between negative emotional state and postural control. Fear and anxiety have been manipulated experimentally through changes in environmental threat, changes in social context, or through the presentation of visual stimuli known to initiate negative emotional responses, in order to quantify the short term effects of emotional changes on postural control. Results indicate that fear and anxiety have significant but, in some cases, differential effects on postural control during static balance and dynamic responses to postural perturbations. Efforts to identify the potential mechanisms through which changes in emotional state may influence postural control have revealed both spinal and supra-spinal contributions, and changes in muscle spindle sensitivity and vestibular reflex gain. This presentation will review recent evidence in support of a causal effect of negative emotional state on human postural control, and the potential mechanisms that may mediate anxiety-related changes in balance performance.

### A fully integrated model of threat assessment, vision, and postural control

**Jeffrey Staab**, Mayo Clinic, USA

BACKGROUND AND AIM: For more than 140 years, clinical observations, clinical research, and physiologic investigations have examined various aspects of the relationships among anxiety, attention, vision, posture, and gait. For the most part, these studies have conceptualized anxiety as a consequence of vestibular and gait disorders or as a disruptive influence on visuo-spatial processing and gait. This presentation argues that threat assessment is a fully integrated and indispensable component of spatial orientation and locomotor control at all times and in all situations in health and disease. METHODS: Studies investigating anxiety disorders and vestibular disorders; state anxiety, response to visuo-spatial stimuli and postural control; trait anxiety, resilience, and recovery after

vestibular insults; and the neuroanatomy of threat, visuo-vestibular, and locomotor control systems in the brain were reviewed. RESULTS: In normal individuals and patients with visuo-vestibular deficits, balance problems, or anxiety disorders, the tendency to be more or less reactive to motion stimuli and perceived postural threat drives locomotor control strategies, conscious attention to gait and posture, clinical symptoms, and functional impairment. CONCLUSIONS: Threat assessment is an inherent element of spatial orientation and locomotion. Anxiety is not a separate cause or consequence of posture and gait problems. Models that fully integrate threat assessment into locomotor control are needed to advance physiologic studies, clinical research, and patient care.

## **Symposium VI:** Wednesday June 26, 10:00 -12:00, Botan

## Predicting disease: Is gait a useful biomarker?

Chair: **Jeffrey Hausdorff,** Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Israel

**Lynn Rochester**, Newcastle University, England

Gait is emerging as a sensitive tool to discriminate incipient pathology with increasing evidence for its role as a biomarker of healthy ageing and disease. Evidence however is largely from studies in the oldest old. Evidence to support the sensitivity of gait to detect early pathology at the prodromal stage and as a tool to discriminate pathology and aid diagnosis is still accumulating, as are the optimal set of gait characteristics and testing protocols. This symposium aims to explore the evidence with respect to the following: Is it possible to detect prodromal disease with gait; do gait characteristics discriminate pathology; do dual task protocols and increased speed add value for discrimination and prediction?

**Predicting Disease: Is Gait A Useful Biomarker?**

**Anat Mirelman**, Tel-Aviv Sourasky Medical Center, Israel

Gait disturbances play a major role in the motor manifestation of many neurodegenerative diseases. Alterations in the gait pattern frequently observed include decreased gait speed, decreased stride length, increased stride-to-stride variability and decreased arm swing. These changes are already apparent in recently diagnosed patients. However, neurodegenerative diseases are known for their long pre-diagnosis phase. Disturbances in smell, sleep, autonomic functions and affect have been reported long before motor changes appear. As such, it is likely that sub-clinical gait alterations are also present in the pre-diagnostic, prodromal phase of neurodegeneration. However, uncovering these changes is challenging as it requires the use of sensitive measures in populations at risk. The objective of this talk is to provide evidence of subtle gait alterations in asymptomatic healthy first degree relatives of patients with Parkinson's disease who are carriers of the G2019S mutation in the LRRK2 gene, subjects who have a heightened risk of developed the disease. In addition, we will explore other motor function abnormalities in populations at risk of neurodegenerative diseases and discuss possible compensatory mechanisms that might mask motor changes in the prodromal phase of disease.

**Gait as an early marker of pathology and clinical outcomes: A cross pathology approach**

**Brook Galna**, Newcastle University, UK

BACKGROUND: Subtle gait deficits in the early stages of disease can provide important information about the mechanisms by which different pathologies impact on functional mobility, and can help identify those at greater risk of both motor and non-motor decline. METHODS: This presentation will focus on the commonalities and differences between three distinct pathologies (Parkinson's disease, Spinocerebellar ataxia and Mitochondrial disease) across a range of gait characteristics. RESULTS: By examining how gait differs within and between the three pathologies as well as controls, we show that discrete measures of gait: i) are sensitive to

subtle changes of motor function in the earliest stages of Parkinson's disease and in pre-clinical Spinocerebellar ataxia; ii) can discriminate between specific genotypes of mitochondrial disease and controls, even in patients who present with phenotypically normal gait on clinical observation; and iii) are sensitive to individual pathological mechanisms, manifesting as distinct patterns across the five domains of gait for each pathology. Finally, we show that gait deficit in early pathology is predictive of deleterious health outcomes, such as falls and cognitive decline. CONCLUSIONS: Gait should be considered a sensitive tool to help us draw inferences about underlying mechanisms of pathology, provide a clinically relevant outcome to assess the effectiveness of interventions and monitor disease progression, and potentially identify patients most at need of early intervention.

**The role and value of dual task balance and gait tests for fall prediction in older people**

**Stephen Lord**, University of NSW, Australia

Dual or secondary task paradigms have been used to explore the attentional requirements of balance control. The premise is that when two tasks are performed simultaneously that require more than the total information processing capacity of a person, performance on either or both tasks deteriorates. Studies have shown that the attention required for balance control increases with the increased complexity of the balance task, the more complex nature of the cognitive task, increased age and reduced balance abilities.

Dual task paradigms have also been included in fall risk factor studies conducted in older people. Some of these studies have demonstrated that dual task cost (i.e. the difference in balance abilities with and without a secondary task) is a significant risk factor for falls. There is conflicting evidence however, as to whether the addition of a secondary cognitive task to a balance or gait test aids in fall prediction over and above balance and gait tasks undertaken under standard conditions. This presentation will summarise findings of studies that have used dual task paradigms in fall risk factor studies undertaken in older people and clinical groups such as those with Parkinson's disease and cognitive impairment. Findings from a systematic review and meta-analysis of the comparative value of gait speed conducted under simple and dual task conditions will also be presented.

## **Symposium VII:** Wednesday June 26, 13:15 - 15:00, Hisho A

## What startles can tell us about posture and gait control

Chair: **Vivian Weerdesteyn**, Radboud University Medical Centre, The Netherlands

**Startling contributions to seated postural responses and audio-spinal reflex pathways in postural control**

**Tim Inglis**, University of British Columbia, Canada

The presentation of a loud startling acoustic stimulus has previously been shown to trigger very rapid but accurate movement responses during reaction time paradigms. The first part of this presentation will review this "StartReact" effect, which has been extensively investigated during simple voluntary limb movements. Secondly, experimental evidence suggests that exaggerated neck muscle responses to transient perturbations consists of combined postural and startle components, and hints at a contribution of startle to the aetiology of whiplash-like injuries. Finally, very recent research has been investigating the contribution of startle stimuli to audio-spinal reflexes. Repeated presentation of loud stimuli, given to the so-called habituated CNS, demonstrate significant but persistent reflexive responses in postural muscles, and these responses may provide a means for investigating the integrity of these descending brainstem pathway contributions that could be involved in postural control.

**Startle and Gait**

**Jacques Duysens**, KU Leuven, Belgium

The startle response is a very basic reaction while gait is a basic motor act. When combined these two activities are not always compatible. How is this resolved? It is argued that the nervous system is usually able to integrate startle responses smoothly by modulating the responses in different phases of the gait. This is seen both in normal subjects and in Parkinson patients, but the latter show less habituation. Startle is also able to facilitate gait initiation and obstacle avoidance (start-react). Furthermore it is argued that startle-like responses are much more common than often assumed. Usually startle is related to auditory stimulation but it is also seen with other forms of sensory input, in particular due to somatosensory stimulation (such as following mechanical perturbation or electrical nerve stimulation). In fact, the transition between startle and non-startle is not easily determined, thereby leading to underestimation of the role of startle circuitry.

**StartReact effects on dynamic postural control**

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

StartReact involves the involuntary, speeded release of a prepared motor response following the presentation of a startling stimulus. Although commonly used with voluntary movements, recent studies have combined StartReact paradigms with cued and uncued balance perturbations to gain new insight into the way in which dynamic balance responses are prepared and influenced by prior experience. StartReact has also proven effective in identifying the potentially startling characteristics of balance perturbations themselves, and the extent to which they may contribute to first trial effects.

**Motor control deficits in CNS diseases - insights from startles**

**Vivian Weerdesteyn**, Radboud University Medical Centre, The Netherlands

When an imperative signal to start moving is combined with a startling auditory stimulus (SAS), reaction times are greatly accelerated. This so-called StartReact effect has not only been demonstrated for simple ballistic movements of the arm, but also for more complex movements, such as gait initiation, obstacle avoidance and sit-to-stance. The shortening of reaction times is hypothesized to be caused by the SAS directly accessing a pre-prepared motor program 'stored' in the brainstem reticular formation (Valls-Sole et al., 2008). It may thus give potential insight into the role of brainstem structures in deficient motor control due to central neurological disorders.

In Parkinson's Disease (PD), difficulties with initiating stepping or gait are common. Deficits in planning and preparation of the preceding anticipatory postural adjustments have been suggested to contribute to these difficulties. Hence, one may expect an impaired StartReact effect on APA latency shortening in PD patients when a cue to start walking is combined with a SAS. Two recent studies, however, demonstrated intact SAS-induced acceleration of the APA, but these were underscaled in magnitude (Rogers et al., 2011; Fernandez-delOlmo et al., 2012). Interestingly, in PD patients with severe freezing of gait an absent StartReact effect has recently been reported for a simple ballistic arm movement, which effect could be restored by pedunculopontine nucleus stimulation (Thevathasan et al., 2011). This exciting observation may help unravel the yet poorly understood pathophysiology of freezing. In patients with corticospinal lesions (e.g. stroke), the cortico-reticulospinal pathway has been proposed as a possible bypass circuit to maintain voluntary motor control, yet at the cost of the commonly observed loss of independent joint control (Ellis et al., 2012). The first results from StartReact experiments indeed provide evidence for a potent reticulospinal drive to both upper and lower extremity muscles in patients with corticospinal lesions. Optimization of the functional exploitation of such a bypass circuit may be an emerging target for future rehabilitation treatment of these patients.

## Symposium VIII: Wednesday June 26, 13:15 - 15:00, Hisho B

## Body and mind interactions in pain and postural control

Chair: **Paul Hodges**, The University Of Queensland, Australia

BACKGROUND AND AIMS: Although early theories proposed that changes in motor behaviour in pain rely on mechanisms at the spinal cord or lower levels of the nervous system, recent work highlights more complex adaptations with evidence of changes at the highest levels of the nervous system. These include changes in the motor and sensory regions of the brain's cortex and an association with cognitive aspects of pain. Of particular interest, these changes have been identified in association with motor behaviours underlying postural control, which are generally controlled subconsciously. Using a range of experimental paradigms this work has aimed to investigate the relationship between postural motor behaviour in people with low back pain (LBP) and: (i) changes in brain organisation, and (ii) beliefs and attitudes about pain. METHODS: This series of studies involved investigation of people with recurring episodes of LBP and healthy control participants. Outcome measures included: temporal and spatial features of activation of the trunk muscles as a component of the anticipatory postural adjustment associated with rapid limb movements; spatial maps of the motor cortex evaluated with transcranial magnetic stimulation; somatosensory evoked potentials; measures of coordination of movement of the lumbar spine and pelvis; and estimation of mechanical properties of the trunk in response to a small mechanical perturbation. RESULTS: Mapping of the motor cortex has revealed a number of key observations;

(i) Areas of the motor cortex with inputs to trunk muscles are not affected uniformly by acute LBP. Excitability of inputs to muscles that stiffen the trunk is enhanced, whereas inputs to the deeper muscles have reduced excitability; (ii) Cortical representation of deep abdominal muscles is shifted posterolaterally, and the amount of shift is linearly correlated with the temporal delay in activation of these muscles in people with LBP; (iii) Although healthy individuals have two main areas of representation of paraspinal muscles on the motor cortex, this is reduced to one in people with recurring LBP. There is preliminary evidence that this "simplification" of the cortical representation is related to changes in motor behaviour such as the ability to coordinate movement of the lumbar spine and pelvis.

Studies investigating the psychosocial domain have identified that although beliefs and attitudes related to pain are associated with how a person reacts to a painful stimulus they do not appear to explain variance in mechanical properties of the trunk.

CONCLUSION: These studies provide strong evidence for involvement the brain and mind in the adaptation of postural motor behaviour in LBP. The results provide evidence that treatment strategies to optimise motor behaviour are likely to require careful attention to the coordination of muscle activity (rather than generalised changes in activation) and attention to psychosocial features of the LBP experience.

**Low Back Pain and Trunk Postural Control**

**Jaap van Dieen**, VU University, The Netherlands

BACKGROUND AND AIM: Postural control of the trunk appears to be affected by low back pain (LBP), which is often attributed to impaired lumbar proprioception. However, reports on effects of LBP on trunk sway in sitting and standing, as well as on the underlying muscle activity in these conditions, are quite inconsistent. In this presentation, I aim to describe a model of trunk postural control that can qualitatively explain these inconsistencies and that may provide guidance for more controlled experimentation. METHODS: An overview of studies on trunk postural control will be given. RESULTS: Maintenance of static trunk posture relies on a combination of intrinsic stiffness of the osteoligamentous spine and cocontracting musculature and feedback control. In recent experiments, we demonstrated that visual, vestibular, tactile and proprioceptive information

each play a role in the feedback control of trunk posture and demonstrated interactions between these sensory modalities. Moreover, interactions between environmental and task conditions and the use of sensory modalities for feedback control of trunk posture were found. These interactions cause differential effects of LBP on trunk postural control when environmental and task conditions are varied. For example, differences between cases and controls and patients are less pronounced in unstable than rigid surface conditions, which may be explained by the smaller role of lumbar proprioceptive information when sitting on an unstable surface, While the above suggests that sensory manipulations and support conditions used in different studies could account for differences in effects of LBP on postural sway between studies, this was not confirmed in a systematic review. Based on the review results, we hypothesized that differences between studies could also arise from competing effects of nociception and fear of pain on trunk postural control. While nociception may disturb proprioceptive feedback and hence cause decreased control over trunk posture, fear of pain or pain-related arousal may lead to increased cocontraction, which may enhance postural control. Data from two recent, large cohort studies provide support for the latter in subjects with LBP, with reduced or similar sway, changes in sway frequency and reduced effects of manipulations of lumbar proprioceptive information compared to healthy subjects, consistent with a 'stiffening strategy'. CONCLUSION; The data presented illustrate that nociception, pain-related cognitions, sensory manipulations, and environmental and task constraints have interacting effects on trunk postural control, which should be taken into account when interpreting and designing studies on LBP and postural control.

**Sensory-motor interactions in experimental pain and postural control**

**Rogerio Hirata**, Aalborg University, Denmark

BACKGROUND AND AIM: Pain has strong correlation with self-reported falls in elderly, where the knee is one of the joints most affected by pain in this population. However, the postural instability in this population may also be affected by other factors than pain such as loss of muscle strength and joint flexibility. This presentation aims to bring a series of recent research showing the effects of experimental pain models in healthy subjects. Such models allow unique findings by isolating the effect of pain in different muscles in relation to control and baseline conditions in healthy young subjects with no other impairments. METHODS: Injections of hypertonic saline were applied to the calf muscles, leg muscles (close to the knee joint) and infrapatellar fat pad. The subjects were asked to either keep their balance as quiet as possible for one minute or recover their upright posture as fast as possible after an external or internal perturbation. Force platforms were used to measure the center of pressure excursions (COP). Bipolar surface EMG electrodes were used bilaterally to estimate muscle activation in relevant postural muscles. Kinematic data from the lower limb segments was acquired to quantify the angular position, displacement and velocity. During the conditions with internal perturbations (fast voluntary movements), anticipatory postural adjustments (APAs) were quantified. RESULTS: The results suggest that when compared with pain free conditions, pain in the lower limb decreases postural stability, increasing postural sway and altering muscular activation during quiet standing and when reacting to external perturbation. When the balance was perturbed internally, pain altered the APAs when compared with pain free conditions. CONCLUSIONS: The changes in muscle activity due to pain were not similar between subjects, indicating that a complex sensory-motor mechanism drives postural adaptations during pain. Additionally, the muscular strategies adopted during pain were not optimal for stabilizing balance, which may partly explain the strong correlation between pain and self-reported falls in elderly individuals. Hence, clinical approaches to reduce pain may lead to improvements in balance especially for elderly people reporting pain.

### Effects of low back pain on lumber movement and contingent negative variation

**Katsuo Fujiwara**, Kanazawa University, Japan

BACKGROUND AND AIM: Sit-to-stand movement is distinguished into the following 4 phases: 1) the anterior displacement of the center of gravity of the trunk by forward inclination of the pelvis, 2) the lift of the buttocks by upward displacement of the pelvis, 3) the transform to standing posture by the extension of the knee and hip joints, and 4) the stabilizing standing posture. It is reported that in people with low back pain (LBP), the movement speed of the greater trochanter is transiently delayed from 2) to 3). However, there is little investigation about the movement of lumber lordosis in sit-to-stand movement. For people with LBP, the movement of lumber lordosis would be decreased in order to fix the lumber region. Furthermore, they would be careful to do the sit-to-stand movement, and therefore prepare for directing attention early and strongly to the movement. The investigation of these characteristics would provide the viewpoints that the issues related to the sit-to-stand movement in people with impairment of postural control could be demonstrated including the control property by central nervous system. For the elderly subjects, we investigated the effects of LBP on lumber movement and contingent negative variation (CNV). METHODS: Subjects were 22 community-dwelling and healthy elderly women aged 60-79 years. The number of subjects with and without LBP (no LBP) was 12 and 10, respectively. Based on the subjective assessment of the pain, the subjects with LBP were classified as 2 groups (mild LBP (N=6) and moderate LBP (N=6)). Two force platforms, one for the seat and the other for floor, were used to measure the center of pressure in the anteroposterior direction (CoPap) and vertical force (Fz) during the sit-to-stand movement. Reflective marker was placed from Th12 to S1. Recording electrodes for electroencephalogram (EEG) were affixed to the scalp at Cz, in accordance with the international 10-20 system. Movement task was the sit-to-stand in the S1-S2 paradigm. S1 and S2 were auditory stimuli with a 2-s interval. In response to S2, subjects stood up toward their quiet standing position. They were instructed to respond to S2 as quickly as possible and to stand up at a comfortable speed. This trial was repeated until 20 EEG waveforms without any artifact were averaged. Movement onset time to S2, movement angle of lumber, and CNV peak latency and amplitude were analyzed. RESULTS: Movement onset time was 241 ± 61 ms in no LBP, 198 ± 35 ms in mild LBP, and 290 ± 60 ms in moderate LBP. The onset time in moderate LBP was significantly later than mild LBP ($p < 0.05$). Inter-trial variation of the onset time tended to be larger in moderate LBP, but no significant group difference was found. Lumber lordsis angle before the movement start did not significantly differ among groups. Moderate LBP tended to once flex the lumber region (i.e. rebound action) about 500 ms after the sit-to-stand movement onset, and then start forward inclination of the pelvis. Lumber movement angle tended to be smaller in moderate LBP than the other groups (no LBP: 9.2 ± 4.7, mild LBP: 9.1 ± 4.2 and moderate LBP: 5.6 ± 1.5). CNV peak latency was -421 ± 281 ms in no LBP, -448 ± 334 ms in mild LBP, and -893 ± 168 ms in moderate LBP. The latency was significantly longer in moderate LBP than the other groups. CNV peak amplitude tended to be smaller in moderate LBP, with no group difference (Fig.1). CONCLUSION: These results suggest that in the sit-to-stand movement, the elderly with moderate LBP would early direct their attention toward upcoming movement to comparatively fix their lumber.

# Poster Index

### Authors and Presenters

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

### 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 - YELLOW

**P2** Poster Session 2 - GREEN

**P3** Poster Session 3 - PINK

**P4** Poster Session 4 - BLUE

All poster boards are colour coded with card, as indicated above.

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

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**B** Sensorimotor control

**C** Exercise and physical activity

**D** Vestibular function and disorders

**E** Orthopedic diseases and injuries

**F** Aging

**G** Aging; Coordination of posture and gait

**H** Coordination of posture and gait

**I** Learning, plasticity and compensation

**J** Activity Monitoring; Aging

**K** Balance support device; Exercise and physical activity

**L** Falls and falls prevention; Aging

**M** Neurological diseases; Aging

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**O** Modeling, robotics and biomechanics and implantable neuroprosthesis

**P** Habilitation and rehabilitation; Cognitive, attentional and emotional influences

**Q** Cognitive impairments; Aging

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**S** Effect of medication on posture and gait; Falls and falls prevention

**T** Ergonomics; Aging

**U** Psychiatric disorders; Vestibular function and disorders

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### Monday, June 24 between 13:15 and 15:15

### A - Tools and methods for posture and gait analysis; Cognitive impairments

**P1-A-1 The problem and device of notation for a power spectrum analysis on stabilometry**

***Masahiko Yamamoto[1]***, **Tomoe Yoshida[1]**, **Fuyuko Ikemiyagi[1]**, **Mitsuya Suzuki[1]**
[1]Toho University

**P1-A-3 Clinical tools to assess balance in children and adults with cerebral palsy: a systematic review**

***Rannei Sæther[1]***, **Jorunn Helbostad[1]**, **Ingrid Riphagen[1]**, **Torstein vik[1]**
[1]Norwegian University of Science and Technology

**P1-A-5 Motion capture technique as a data source for computation of chosen gait indices as measures of gait asymmetry**

***Henryk Josinski[1]***, **Adam Switonski[1]**, **Magdalena Stawarz[2]**, **Romualda Mucha[3]**, **Konrad Wojciechowski[1]**
[1]Polish-Japanese Institute of Information Technology, [2]Silesian University of Technology, [3]Medical University of Silesia

**P1-A-7 A new biomechanical interpretation of results from stabilogram-diffusion analysis**

***Naoko Oba[1]***, **Shun Sasagawa[1]**, **Akio Yamamoto[1]**, **Kimitaka Nakazawa[1]**
[1]The University of Tokyo

**P1-A-9 Validity of the step length asymmetry estimated by an accelerometer in patients with stroke**

***Kazuaki Oyake[1]***, **Tomofumi Yamaguch[2]**, **Shigeo Tanabe[3]**, **Kunitsugu Kondo[1]**, **Yohei Otaka[1]**
[1]Tokyo Bay Rehabilitation hospital, [2]Graduate School of Medicine, Keio University, [3]Fujita Health University

**P1-A-11 Development of a Tool for Measuring Muscle Synergy in People with Stroke: A pilot study**

***Rufai Ahmad[1]***, **Huzaifa Abubakar[1]**, **Abdulhamid Maje[1]**, **Rabiu Magaji[2]**
[1]Bayero University, [2]Ahmadu Bello University

**P1-A-13 Deviation Tendency of Stepping Test**

***Yasuyuki Nomura[1]***, **Teruo Toi[1]**, **Yoshiro Wada[2]**, **Jacob Bloomberg[3]**, **Ajitkumar Mulavara[1]**
[1]Nihon University School of Medicine, [2]Nara Medical University, [3]NASA

**P1-A-15 Detecting Freezing-of-Gait Episodes in People with Parkinson Disease by Lower Limb Kinetic Energy**

***Wen-Chieh Yang[1]***, **Hung-Bin Chen[1]**, **Wei-Li Hsu[2]**, **Jian-Jiun Ding[1]**, **Kwan-Hwa Lin[2]**
[1]National Taiwan University, [2]College of Medicine, National Taiwan University

**P1-A-17 Adaptive activity classification of compound activities facilitates detailed 3D kinematic and kinetic analyses in ambulatory monitoring**

***Chris Baten[1]***, **Jose De Zeeuw[1]**, **Ruben Wassink[1]**, **Arjen Bergsma[1]**
[1]University of Twente

**P1-A-19 The effects of the knee braces on gait - toward leg disorder estimation from images**

***Takuya Ogawa[1]***, **Hirotake Yamazoe[1]**, **Ikuhisa Mitsugami[1]**, **Yasushi Yagi[1]**
[1]Osaka University

**P1-A-21 Balance and gait measures as predictors of cognitive function in post-stroke patients**

***Einor Ben Assayag[1]***, **Shani Shenhar-Tsarfaty [1]**, **Efrat Kliper[1]**, **Hen Hallevi [1]**, **Ludmila Shopin [1]**, **Natan Bornstein [1]**, **Amos Korczyn [1]**, **Nir Giladi[1]**, **Anat Mike[1]**, **Anat Mirelman [1]**, **Aner Weiss[1]**, **Jeffrey Hausdorff[1]**
[1]Tel Aviv Sourasky Medical Center

**P1-A-23 Detection of active co-regulation of the structure and magnitude of stride time variability**

***Espen Alexander Ihlen[1]***, **Beatrix Vereijken[1]**
[1]Norwegian University of Science and Technology

**P1-A-27 Dynamic models provide insight into how motor trainings improve posture in aging**

***Olivier Coubard[1]***, **Lena Ferrufino[1]**, **Blandine Bril[2]**, **Tetsushi Nonaka[3]**, **Gilles Dietrich[4]**
[1]CNS-Fed, [2]Ecole des Hautes Etudes en Sciences Sociales, [3]Kibi International University, [4]Université Paris Descartes

**P1-A-29 Instrumented Functional Reach for Fall Risk Assessment**

***Andrea Cattabriga[1]***, **Sabato Mellone[1]**, **Luca Palmerini[1]**, **Carlo Tacconi[1]**, **Chiara Mussi[1]**, **Lorenzo Chiari[2]**
[1]University of Bologna, [2]Universita' degli studi di Modena e Reggio Emilia

**P1-A-31 Desired center of pressure describes falls caused by induced slips**

***Takeshi Yamaguchi[1]***, **Kei Masani[2]**, **Shinya Fukuzawa[2]**, **Hiroshi Onodera[1]**, **Kazuo Hokkirigawa[3]**
[1]Tohoku University, [2]University of Toronto, [3]Japan Science and Technology Agency (JST)

**P1-A-33 An analytical approach to find the range of feasible body movements for the control of balance**

***Mohammad Hadi Honarvar[1]***, **Motomu Nakashima[1]**
[1]Tokyo Institute of Technology

**P1-A-35 Kinematic analysis of segmental trunk movement during sit-to-stand in hemiplegic patients**

***Kazuhiro Ito[1]***, **Yasuhiko Hatanaka[1]**, **Takaaki Nakamata[2]**, **Koichi Saito[2]**, **Ryota Maegawa[2]**, **Yuka Kitagawa[1]**, **Yukiko Uno[1]**, **Megumi Kitagawa[1]**, **Kimiyoshi Tamura[1]**
[1]Oumionsen hospital, [2] Suzuka University of Medical Science

**P1-A-37 A validation method for BSIP estimation techniques**

**Gentiane Venture[1]**, **Clint Hansen[2]**, **Nasser Rezzoug[3]**, **Brice Isableu[2]**, **Philippe Gorce[3]**
[1]Tokyo University of Agriculture and Technology, [2]Univ. Paris-Sud, [3]Univ Du Sud. Toulon Var

**P1-A-39 Developing a functionally relevant test for dual task assessment in Parkinsons Disease**

***Carolien Strouwen[1]***, **Pieter Ginis[1]**, **Samyra Keus[2]**, **Esther Molenaar[2]**, **Liesbeth Münks[1]**, **Marten Munneke[2]**, **Alice Nieuwboer[1]**
[1]KU Leuven, [2]Radboud University Nijmegen Medical Centre

**P1-A-41 Quantification of changes in gait characteristics associated with intermittent claudication in patients with lumber spinal stenosis**

***Koutatsu Nagai[1]***, **Tomoki Aoyama[2]**, **Minoru Yamada[2]**, **Masanori Izeki[2]**, **Shunsuke Fujibayashi[2]**, **Mitsuru Takemoto[2]**, **Shu Nishiguchi[1]**, **Tadao Tsuboyama[1]**, **Masashi Neo[3]**
[1]Kyoto Tachibana University, [2]Kyoto University, [3]Osaka Medical College

**P1-A-43 Characteristic findings of stabilometry in patients with cervical vertigo**

***Akiko Taura***[1], **Kazuo Funabiki**[2], **Hiroko Torii**[3], **Mami Matsunaga**[3], **Juichi Ito**[3]
[1]Kyoto University Hospital, [2]Osaka Bioscience Institute, [3] Kyoto University

**P1-A-45 Cortical responses during the dynamic posturography detected by functional near infrared spectroscopy(fNIRS)**

***Hiromasa Takakura***[1], **Hideo Shoujaku**[1], **Hisao Nishijo**[1]
[1]Graduate school of Medicine and Pharmaceutical Sciences, University of Toyama

**P1-A-47 Toward Instant Diagnosis in Balance Disorders Using Kinect**

***Hiroyuki Funaya***[1], **Tomohiro Shibata**[1], **Yoshiro Wada**[2], **Toshiaki Yamanaka**[2]
[1]Nara Institute of Science and Technology, [2]Nara Medical University

## B - Sensorimotor control

**P1-B-49 Enhanced proprioceptive postural control after inspiratory muscle training in individuals with low back pain**

***Lotte Jansssens***[1], **Thierry Troosters**[1], **Alison McConnell**[2], **Roeland Lysens**[2], **Madelon Pijnenburg**[1], **Nina Goossens**[1], **Jonas Raymaekers**[1], **Simon Brumagne**[1]
[1]KU Leuven, [2]Brunel University

**P1-B-51 Establishing stimulation profiles for cutaneous receptors in the human foot sole**

***Nicholas Strzalkowski***[1], **Leah Bent**[1]
[1]University of Guelph

**P1-B-53 Congenital nystagmus may be not conjugate eye movements? -Report of our two cases-**

***Tomoyuki Okada***[1], **Masahiko Fukasawa**[1], **Yasuhiro Miyamoto**[1], **Yasuhiko Tanaka**[2], **Izumi Koizuka**[1]
[1]St Marianna University School of Medicine, [2]St Marianna University Yokohama City Hospital

**P1-B-55 Dominant Effect of Visual Motion Cues on the Motion Perception Under Sensory Conflict Condition is Represented by High Sensory Weight in Internal Model**

***Sue Park***[1], **Hyerim Lim**[1]
[1]KAIST

**P1-B-57 Effects of Aging on Vestibular and Lower Limb Somatosensory input Interaction for Head and Trunk control during Normal and Narrow-based Walking**

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

**P1-B-59 Characteristics of force- and timing-control in aging: A study of foot-tapping**

***Koji Takimoto***[1], **Hideaki Takebayashi**[1], **Kenzo Miyamoto**[1], **Hideto Kaba**[2]
[1]Tosa Rehabilitation College, [2]Kochi Medical School

**P1-B-61 Head stabilization during walking on a compliant surface**

***Egidio Falotico***[1], **Colas Authié**[1], **Kenji Hashimoto**[2], **Cecilia Laschi**[3], **Daniel Bennequin**[1], **Paolo Dario**[4], **Alain Berthoz**[1]
[1]Scuola Superiore Sant'Anna, [2]CNRS - Collège de France, [3]Waseda University, [4]Institut de Mathématiques de Jussieu

**P1-B-63 Is dynamic visual information obtained at remote place available for locomotion through apertures?**

***Daisuke Muroi***[1], **Takahiro Higuchi**[1]
[1]Tokyo Metroplitan University,

**P1-B-65 Control of load and center of pressure of each left and right lower limb in anticipatory postural adjustments during multi-directional gait initiation**

***Masaki Yukimune***[1], **Tomonori Sawada**[1], **Nobuhiro Kito**[1]
[1]Hiroshima International University

**P1-B-67 Effect of various information of sensory modality on the postural control**

***Hideaki Takebayashi***[1], **Suzuno Hiroi**[1], **Koji Takimoto**[1], **Kenzo Miyamoto**[1], **Yutaka Takuma**[1], **Inoue Yoshikazu**[1], **Shoko Miyamoto**[1], **Takao Okabe**[1], **Shu Morioka**[2]
[1]Tosa Rehabilitation College, [2]Kio University

**P1-B-69 Effect of temporal and spatial predictions to perturbations on stretch reflex responses of ankle extensor and flexor muscles during standing**

***Kimiya Fujio***[1], **Hiroki Obata**[1], **Noritaka Kawashima**[2], **Kimitaka Nakazawa**[1]
[1]The University of Tokyo, [2]Research institute of the National Rehabilitation Center for Persons with Disabilities

**P1-B-71 Walking on a split-belt treadmill independently affects H-reflex modulation and muscles background activation**

***Firas Massaad***[1], **David Drijkoningen**[1], **Karen Jansen**[1], **Pieter Meyns**[1], **Oron Levin**[1], **Ilse Jonkers**[1], **Jacques Duysens**[1]
[1]KULeuven

**P1-B-73 Larger somatosensory stimuli contribute to the improvement of motor control and motor skill acquirement**

***Satoshi Kasahara***[1], **Hiroshi Saito**[1], **Mina Samukawa**[2]
[1]Japan, [2]Hokkaido University

## C - Exercise and physical activity

**P1-C-77 Biomechanical characteristics of walking on a shallow slope**

***Sho Watanabe***[1], **Takaharu Hosoda**[1], **Shin-ichiro Yamamoto**[1], **Noritaka Kawashima**[2]
[1]Shibaura Institute of Technology, [2]Research Institute of NRCD, Japan

**P1-C-79 Effects of Interactive Video-Game Based Exercise on balance in Diabetic Neuropathy**

***Shih-Ching Chen***[1], **Chien-Hung Lai**[1], **Yu-Ru Wu**[1], **Chih-Wei Peng**[1], **Chun-Wei Kang**[1], **Yu-Luen Chen**[1]
[1]Taipei Medical University

**P1-C-81 The Effect of a Nintendo® Wii Exercise Intervention on Gait in Older Adults**

***Anna Lee***[1], **John Biggan**[1], **Wyn Taylor**[1], **Ketaki Deo**[1], **Christopher Ray**[1]
[1]University of Texas at Arlington

**P1-C-83 The influence of taping on Kendo player**

***Jing-Min Liang***[1], **Chun-Hao Huang**[1], **Wen-Lan Wu**[1], **Jing-Min Liang**[1]
[1]Kaohsiung Medical University

**P1-C-85 The predictors of improvement in walking ability in patients 1 month after total knee arthroplasty**

***Masashi Taniguchi***[1], **Kazuki Uemura**[2], **Shoji Maegawa**[2], **Yuka Kojima**[1], **Chieko Ohzaki**[1], **Masato Kugo**[1], **Taku Kawasaki**[1]
[1]Division of Physical Therapy, Rehabilitation Units, Shiga University of Medical Science Hospital, [2]Graduate School of Medicine, Nagoya University

**P1-C-87 A Pilot Study of a Novel Arrangeble Light Weight Force Sensors Systems for Balance Training.**

***Suppachet Panya***[1], **Prakarnkiat Youngkong**[1]
[1]King Mongkut's University of Technology Thonburi

**P1-C-89 Effects of Interactive Video-Game Based Exercise on balance in Parkinson's disease**

***Chien-Hung Lai***[1], **Hou-Chang Chiu**[1], **Shih-Ching Chen**[2], **Yu-Ru Wu**[1], **Chih-Wei Peng**[1], **Ming-Jun Lai**[1], **Yu-Luen Chen**[3]

[1]Taipei Medical University Hospital, [2]Shin Kong WHS Memorial Hospital, [3]Nursing and Management College

Chien-Hung Lai M.D., Ph.D.1,2, Hou-Chang Chiu M.D.3, Shih-Ching Chen M.D., Ph.D.1,2, Yu-Ru Wu, P.T.1,2, Chih-Wei Peng P.T., Ph.D.1,2, Ming-Jun Lai M.D. 1,2, Yu-Luen Chen Ph.D.4,5 1 Department of Physical Medicine and Rehabilitation, School of Medicine, College of Medicine, Taipei Medical University 2 Department of Physical Medicine and Rehabilitation, Taipei Medical University Hospital 3 Neurology, Shin Kong WHS Memorial Hospital, Taipei, Taiwan 4 Catholic St. Mary's Medicine, Nursing and Management College 5 Department of Computer Science, National Taipei University of Education, Taipei, Taiwan Abstract

**P1-C-91 Lower limb movement modifications affect trunk and pelvis in females with patellofemoral pain**

***Valentina Graci***[1], **Gretchen Salsich**[2]

[1]University of Maryland School of Medicine, [2]Saint Louis University

## D - Vestibular function and disorders

**P1-D-93 Correlations between foam posturography and vestibular-evoked myogenic potential tests in Meniere's disease**

***Bing-Yi Lin***[1], **Chuan-Yi Lin**[1], **Shou-Jen Wang**[1], **Yi-Ho Young**[1]

[1]National Taiwan University Hospital

**P1-D-95 Walking balance tests to screen for vestibular disorders**

***Helen Cohen***[1], **Jacob Bloomberg**[2], **June Kampangkaew**[1], **Ajitkumar Mulavara**[3], **Brian Peters**[4], **Natalia Ricci**[5], **Haleh Sangi-Haghpeykar**[1], **Robert Williamson**[1], **Jeffrey Vrabec**[1]

[1]Baylor College of Medicine, [2]NASA/ Johnson Space Center, [3]Universities Space Research Association, [4]Wyle Science, Technology and Engineering Group, [5]Federal University of Sao Paulo

**P1-D-97 Balance Symptoms at Referral of Patients With Peripheral Vestibular Disease**

***Kathrine Jauregui-Renaud***[1], **Aralia Gutierrez-Marquez**[1], **Leticia Viveros-Rentería** [1], **Verónica Ramos-Toledo** [1], **Fátima Gómez-Alvarez**[1]

[1]Instituto Mexicano del Seguro Social

**P1-D-101 Balance control in phobic postural vertigo**

***Klaus Jahn***[1], **Roman Schniepp**[1], **Sigbert Krafczyk**[1], **Thomas Brandt**[1], **Max Wühr**[1]

[1]University of Munich

**P1-D-103 The age difference of postural sway under the different eye-to-object distance and downward gazing**

***Osamu Aoki***[1], **Yoshitaka Otani**[2], **Kazuhisa Domen**[3]

[1]Shijonawate Gakuen University, [2]Kobe International University, [3]Hyogo College of Medicine

**P1-D-105 Changes in the tracking axis of the Body Tracking Test among healthy people and patients with vestibular neuronitis**

***Tomoe Yoshida***[1], **Masahiko Yamamoto**[1], **Yuya Tamura**[1], **Toshitake Tanaka**[1], **Fuyuko Ikemiyagi**[1], **Yoshihiro Ikemiyagi**[1], **Mitsuya Suzuki**[1]

[1]Toho University Sakura Medical Center

**P1-D-107 Two cases with Wernicke's encephalopathy**

***Yasuo Ogawa***[1], **Nobuhiro Nishiyama**[1], **Taro Inagaki**[1], **Koji Otsuka**[1], **Mamoru Suzuki**[1]

[1]Tokyo Medical University

## E - Orthopedic diseases and injuries

**P1-E-109 Spatial perception Space perception and motor behavior in young adults with scoliosis**

***Jensuh Chern***[1], **Chia-Chi Gao**[1], **Lai Po-Liang**[2], **Chi-Wen Lung** [3], **Chia-ching Li** [1], **Szu-Yu Chen** [1]

[1]Chang Gung University, [2]Lin kuo Chang Gung Memorial Hospital , [3]Asia University

**P1-E-111 Gait parameters and knee adduction moment during walking in subjects with knee osteoarthritis**

***Yui Takagi***[1], **Hiroshige Tateuchi**[2], **Yusuke Goto**[2], **Naoki Otsuka**[2], **Masashi Kobayashi**[3], **Koji Sato**[1], **Noriaki Ichihashi**[2]

[1]Nagoya University Hospital, [2]Kyoto University, [3]Kobayashi orthopedic clinic

**P1-E-113 Compensatory Muscle Activations during Forward Reach Task after Minimal Invasive Spinal Fusion Surgery**

***Ting-Yun Wang***[1], **Chen-Hsi Hsiao**[1], **Jwo-Luen Pao**[2], **Rong-Sen Yang**[3], **Wei-Li Hsu**[1]

[1]National Taiwan University, [2]Far Eastern Memorial Hospital, [3]National Taiwan University Hospital

**P1-E-115 Do knee osteoarthritis patients perform efficient Sit-to-stand motion?**

***Masaya Anan***[1], **Koichi Shinkoda**[1], **Kentaro Suzuki**[2], **Masahide Yagi**[3], **Takuya Ibara**[4], **Nobuhiro Kito**[5]

[1]Hiroshima University, [2]Nagoya University Hospital, [3]Midorii Orthopaedics Joint Reconstruction & Arthroscopy, [4]Kawashima Orthopaedic Hospital, [5]Hiroshima International University

**P1-E-117 The effects of fatigue on adopted drop-landing mechanics**

***Brian Street***[1], **Dmitry Verniba**[1], **William Gage**[1]

[1]York University

## F - Aging

**P1-F-119 Gender specific associations of anthropometry with postural balance during feet-together stance in the elderly**

***Ji-Won Kim***[1], **Yu-Ri Kwon**[1], **Gwang-Moon Eom**[1]

[1]Konkuk University

**P1-F-121 Effects of age and gender on mediolateral balance control in gait**

***Masaru Ichikawa***[1], **Takehiro Tagawa**[1], **Shingo Takashima**[1], **Yuusuke Torii**[1], **Tsuyoshi Nishiwaki**[1]

[1]ASICS Corporation

## G - Aging; Coordination of posture and gait

**P1-G-123 Trunk variability during gait decreases the year after cataract surgery in older people**

***Ole Petter Norvang***[1], **Thorlene Egerton**[1], **Jorunn Helbostad**[1]

[1]NTNU

**P1-G-125 Toe clearance and walking pattern on responding to unexpected surfaces in dual task; comparison between healthy older and young adults**

***Nobuko Harada***[1], **Shuichi Okada**[2]

[1]Osaka Yukioka College of Health Science, [2]Kobe University

## H - Coordination of posture and gait

**P1-H-127 Inter-joint Coordination in Patients with Cervical Spondylosis During Obstacle Crossing**
***Tung-Wu Lu***[1], **Zhi-You Chen**[1], **Dar-Ming Lai**[1], **Wei-Ching Lo**[1]
[1]National Taiwan University,

**P1-H-129 Control of Segment Variability and Postural Challenge with Varying Walking Speeds**
***Stephen Prentice***[1], **Glynnis Pardo**[1], **Kunal Khare**[1], **Nicholas Frank**[1]
[1]University of Waterloo

**P1-H-131 Implicit adjustment of postural control strategy with a real-time feedback movable footplate**
***Noritaka Kawashima***[1], **Hisakazu Ihara**[2]
[1]Research Institute of NRCD, Japan, [2]Shibaura Institute of Technology

**P1-H-133 Postural control strategy under water environment**
***Hisakazu Ihara***[1], **Shin-ichiro Yamamoto**[1], **Noritaka Kawashima**[2]
[1]Shibaura Institute of Technology, [2]Research Institute of NRCD, Japan

## I - Learning, plasticity and compensation

**P1-I-135 Using a robotic AFO to study the extent/limits of short-term adaptive plasticity during human walking.**
***Laurent Bouyer***[1]
[1]CIRRIS-Universite Laval

**P1-I-137 Type 2 diabetes alters the relationship between cerebral blood flow and gait speed in older adults**
***Azizah Jor'dan***[1], **Brad Manor**[1], **Vera Novak**[1]
[1]Harvard Medical School/Beth Israel Deaconess Medical Center

**P1-I-139 Do individuals account for increases in body size when walking through apertures?**
***Amy Hackney***[1], **Michael Cinelli**[2], **Jim Frank**[1]
[1]University of Waterloo, [2]Wilfrid Laurier University

## J - Activity Monitoring; Aging

**P1-J-141 Physical behaviour and function early after hip fracture - part of the Trondheim Hip Fracture Trial**
***Kristin Taraldsen***[1], **Olav Sletvold**[1], **Pernille Thingstad**[2], **Ingvild Saltvedt**[1], **Malcolm Granat**[3], **Jorunn Helbostad**[2]
[1]NTNU, [2]St.Olavs University Hospital and NTNU, [3]Glasgow Caledonian University

**P1-J-143 Observation of Gait Changes Associated with Human Intentions**
***Mitsuru Nakazawa***[1], **Ikuhisa Mitsugami**[1], **Hirotake Yamazoe**[1], **Yasushi Yagi**[1]
[1]Osaka University

**P1-J-145 Validity and reliability of accelerometers and GPS to measure community ambulation after stroke.**
***Niruthikha Mahendran***[1]
[1]University of Queensland

## K - Balance support device; Exercise and physical activity

**P1-K-147 Evaluation of sitting balance in elderly persons**
***Kimio Saito***[1], **Toshiki Matsunaga**[2], **Takehiro Iwami**[3], **Yoichi Shimada**[1]
[1]Akita University Graduate School of Medicine, [2]Akita University Hospital, [3]Akita University

**P1-K-149 Limit of Stability Changes between Young and Middle-Old Aged Groups after Ankle Fracture**
***Yun-Chen Yeh***[1], **Fang-Ching Lin**[1], **Shuya Chen**[1], **Ying-Hao Chen**[1], **Hsiu-Chen Lin**[1], **Horng-Chaung Hsu**[1]
[1]China Medical University

# Poster Session 2 GREEN

**Monday, June 24 between 15:30 and 17:30**

## L - Falls and falls prevention; Aging

**P2-L-151 Choice step reaction to a selective attention task is prolonged by errors of postural preparation in older adults**
***Kazuki Uemura***[1], **Shuhei Takahashi**[1], **Hiroki Togo**[1], **Masato Kako**[1], **Yasushi Uchiyama**[1]
[1]Nagoya University

**P2-L-153 Essential Concept of Fall-risk Classification and Formulae to Consider Fall-risk Scores**
***Hisao Nagata***[1]
[1]Institute for Science of Labour

**P2-L-155 How fear of falling influences visual behaviours during adaptive gait.**
***William Young***[1], **Mark Hollands**[2]
[1]Brunel University, [2]Liverpool John Moores University

**P2-L-157 Older adults perform worse than young in a dual task when response inhibition is required**
***Zrinka Potocanac***[1], **Ellen Smulders**[2], **Mirjam Pijnappels**[3], **Sabine Verschueren**[3], **Jacques Duysens**[1]
[1]KU Leuven, [2]Tolbrug RC 's-Hertogenbosch, [3]VU Amsterdam

**P2-L-159 The Community Balance and Mobility Scale alleviates the ceiling effects observed in the currently used assessments for the higher-functioning community dwelling elderly**
***Chitra lakshmi K Balasubramanian***[1], **Dawn Saracino**[1]
[1]University of North Florida

**P2-L-161 Does arm swing emphasized deliberately increase the trunk stability during walking in the elderly adults?**
***Sho Nakakubo***[1], **Doi Takehiko**[2], **Sawa Ryuichi**[1], **Misu Shogo**[3], **Tsutsumimoto Kota**[2], **Ono Rei**[1]
[1]Kobe University Graduate School of Health Sciences, [2]Section for Health Promotion Department for Research and Development to Support Independent Life of, [3]Kobe City Hospital Organization, Kobe City Medical Center West Hospital

**P2-L-163 The effects of route previewing on gaze behavior during adaptive locomotion**
***Benjamin Curzon-Jones***[1], **Mark Hollands**[2]
[1]University of Birmingham, [2]Liverpool John Moores University,

**P2-L-165 Mechanism underlying protective stepping response: Effect of light touch and age**

***Tippawan O-Phartkaruna***[1], **Sopa Pichaiyongwongdee**[1], **Jarugool Tretriluxana**[1], **Roongtiwa Vachalathiti**[1]
[1]Mahidol University

**P2-L-167 Effect of task complexity on cognitive and motor prioritization during dual-task walking**

***Tanvi Bhatt***[1] **Prakruti Patel**[1]
[1]University of Illinois

**P2-L-169 Combining stepping and cognition: the ability of two tests to discriminate between fallers and non-fallers**

***Daniel Schoene***[1], **Kim Delbaere**[1], **Stuart Smith**[1], **Stephen Lord**[1]
[1]Neuroscience Research Australia

**P2-L-171 Alcohol intoxication changes posture alignment strategies when standing with eyes open and closed**

***Anna Hafstrom***[1], **Mitesh Patel** [3], **Mans Magnusson**[1], **Per-Anders Fransson**[1]
[1]Skane University Hospital, [2]Department of Otorhinolaryngology Head and Neck surgery

**P2-L-173 Uncontrolled Manifold Analysis of Obstacle-Crossing in Young Adults**

***Wei-Chun Tsai***[1], **Jia-Da Li**[1], **Tung-Wu Lu**[1]
[1]National Taiwan University

**P2-L-175 Temporal response of human bipedal walking to a perturbation induced by a split-belt treadmill**

***Takaaki Oku***[1], **Naomichi Ogihara**[1]
[1]Keio University

**P2-L-177 Detecting freezing of gait and falls using motion recorder and home video in Parkinson's disease patients during everyday activities**

***Yasuyuki Okuma***[1], **Hiroshi Mitoma**[2], **Mitsuru Yoneyama**[3]
[1]Juntendo University Shizuoka Hospital, [2]Tokyo Medical University, [3]Mitsubishi Chemical Group Science and Technology Research Center

**P2-L-179 Physiopathology of freezing of gait (FOG) and falls in Parkinson's disease (PD) patients treated with subthalamic (STN) deep brain stimulation (DBS)**

***Florence Cormier-Dequaire***[1], **Sara Fernandez Vidal**[1], **Adele Demain**[1], **Hayat Belaich**[1], **Carine Karachi**[1], **Marie Vidailhet**[1], **David Grabli**[1], **Marie-Laure Welter**[1]
[1]Pitie-Salpetriere Hospital

**P2-L-181 Does the Vitamin D multi-nutrient supplementation increase the fluidity of sit-to-walk motion in chronic stroke patients?**

***Yuji Osada***[1], **Noriko Hagiwara**[1], **Saori Tanabe**[1], **Mizuho Ota**[1], **Hirotaka Shimizu**[1], **Hideyuki Nanri**[1], **Masako Fuchi**[1], **Setsuro Ibayashi**[1]
[1]Seiai Rehabilitation Hospital

**P2-L-183 Eye-foot coordination and lateral stability: protective stepping following balance perturbations versus voluntary stepping**

***Valentina Graci***[1], **Robert Creath**[1], **Joseph Barton**[1], **Kaitlin Riddle**[1], **Mark Rogers**[1]
[1]University of Maryland School of Medicine

## M - Neurological diseases; Aging

**P2-M -185 Cortical gray matter volume and gait functions in Parkinson disease**

***Martijn Muller***[1], **Roger Albin**[1], **Kirk Frey**[1], **Nicolaas Bohnen**[1]
[1]University of Michigan

**P2-M -187 Neuroanatomy of space, body and posture perception in brain-damaged patients**

***Arnaud Saj***[1], **Jacques Honoré**[2], **Patrik Vuilleumier**[1], **Marc Rousseaux**[3]
[1]University Hospital of Geneva, [2]University of Lille Nord de France, [3]Lille University Medical Center

**P2-M -189 Feasibility of Using Inertial Sensors in the Clinic with DBS Patients to Assess Gait and Balance**

***Patricia Carlson-Kuhta***[1], **Martina Mancini**[1], **Shannon Donovan**[1], **Matthew Brodsky**[1], **Fay Horak**[1]
[1]Oregon Health & Science University

**P2-M -193 The effects of a concurrent motor task on walking in Alzheimers disease**

***Joanne Wittwer***[1], **Kate Webster**[1], **Keith Hill**[2]
[1]La Trobe University, [2]Curtin University

**P2-M -195 Postural set rigidity in Parkinson's disease does not impair compensatory stepping**

***Katrijn Smulders***[1], **Rianne Esselink**[1], **Bert De Swart**[1], **Alexander Geurts**[1], **Bastiaan Bloem**[1], **Vivian Weerdesteyn**[1]
[1]Radboud University Nijmegen Medical Centre

**P2-M -197 Reversible astasia-abasia syndrome caused by callosal infarction**

***Sachiko Kamada***[1], **Masashiro Sugawara**[1], **Satoshi Ohkawa**[1], **Akira Hanazono**[1], **Masazumi Matsuda**[1], **Fusako Takeda**[1], **Hirohide Ohnishi**[1], **Itaru Toyoshima**[1]
[1]Department of Neurology, Akita University School of Medicine

**P2-M -199 The efficiency of functional gait training by using virtual and augmented reality on symmetrization and speed of walking in postacute stroke patient**

***Zuzana Jurutkova***[1], **Lucie Szmekova**[1], **Petra Bastlova**[1], **Barbora Kolarova**[1], **Alois Krobot**[1]
[1] Palacky University in Olomouc

**P2-M -201 Relation between arm posture and gait instability in typically developing children and children with hemiplegia**

***Pieter Meyns***[1], **Sjoerd Bruijn**[1], **Jacques Duysens**[1], **Kaat Desloovere**[1]
[1]KU Leuven

**P2-M -203 Additional weight load increases the number of freezing of gait episodes in idiopathic Parkinson's disease**

***Lars Oude Nijhuis***[1], **Senja Mensink**[1], **Jorik Nonnekes**[1], **Geert van Bon**[1], **Anke Snijders**[1], **Jacques Duysens**[2], **Vivian Weerdesteyn**[1], **Bastiaan Bloem**[1]
[1]Radboud University Nijmegen Medical Centre, [2]Katholieke Universiteit Leuven

**P2-M -205 GBA-PD versus sporadic PD: Difference in postural control**

***Karin Srulijes***[1], **Senait Ogbamicael**[1], **Kathrin Brockmann**[1], **Markus Hobert**[1], **Mirjam Maechtel**[1], **Sandra Hasmann**[1], **Daniela Berg**[1], **Walter Maetzler**[1]
[1]Center of Neurology, University of Tuebingen

**P2-M -207 Association between muscle coactivation and center of pressure movement during gait initiation in individuals with hemiplegia after stroke**

***Ryosuke Kitatani***[1], **Koji Ohata**[1], **Yu Hashiguchi**[1], **Natsuki Yamakami**[1], **Kaoru Sakuma**[1], **Yumi Aga**[1]
[1]Kyoto University

**P2-M -209 Factors affecting stiff-legged gait in Cerebral Palsy**
***Jonathan Marsden***[1], **Elle Compton**[1], **Gary Shum**[1], **Robert Jeffery**[2], **Ben Bradley**[3]
[1]Plymouth University, [2]Plymouth Hospitals NHS Trust, [3]South Devon Healthcare NHS Foundation Trust

**P2-M -211 Resting state functional connectivity in the motor network in individuals with Parkinson disease**
***Kristen Pickett***[1], **Daniel Peterson**[1], **Jonathan Koller**[1], **Meghan Campbell**[1], **Abraham Snyder**[1], **Joel Perlmutter**[1], **Gammon Earhart**[1]
[1]Washington University School of Medicine

**P2-M -213 Kinematic analysis of reaching movement with different height of obstacle in stroke patients.**
***Shih-Wun Hong***[1], **Hei-Fen Mao**[2], **Jiann-Shing Jeng**[3], **Tung-Wu Lu**[1]
[1]Institute of Biomedical Engineering, National Taiwan University, Taiwan, [2]School of Occupational Therapy, National Taiwan University, Taiwan, [3]Department of Neurology, National Taiwan University Hospital, Taiwan

## N - Cognitive, attentional and emotional influences

**P2-N-215 Preclinical mobility disability in people with Parkinson's disease: a survey**
***Robyn Lamont***[1], **Meg Morris**[2], **Marjorie Woollacott**[3], **Sandra Brauer**[1]
[1]University of Queensland, [2]Latrobe University, [3]University of Oregon

**P2-N-217 The benefits of cognitive and physical training on dual-task walking**
***Karen Li***[1], **Sarah Fraser**[2], **Patrick Roy**[2], **Lora Lehr**[2], **Maxime Lussier**[2], **Nicolas Berryman**[2], **Laurence Desjardins-Crépeau**[2], **Thien Tuong Minh Vu**[2], **Marie-Jeanne Kergoat**[2], **Louis Bherer**[1]
[1]Concordia University, [2]Centre de recherche institut universitaire de gériatrie de Montréal (CRIUGM)

**P2-N-219 Adapting postural responses on the basis of constraints imposed by a voluntary task in the elderly**
***Andrea De Lima-Pardini***[1], **Daniel Coelho**[1], **Marina Silva**[1], **Luis Teixeira**[1]
[1]University of Sao Paulo

**P2-N-221 Precueing about kind and time of perturbation leads to improved postural responses in young and older individuals**
***Marina Silva***[1], **Daniel Coelho**[1], **Thais Baptista**[1], **Alessandra Martinelli**[1], **Andrea Pardini**[1], **Luis Teixeira**[1]
[1]USP

**P2-N-223 Adaptive postural response to imagined arm movements in older people**
***Nicola Doherty***[1], **Elizabeth Maylor**[1], **Suvobrata Mitra**[1]
[1]University of Warwick

**P2-N-225 The impacts of fear of falling on trunk variability during gait in community-dwelling elderly**
***Ryuichi Sawa***[1], **Takehiko Doi**[2], **Kota Tsutsumimoto**[2], **Shogo Misu**[3], **Sho Nakakubo**[1], **Tsuyoshi Asai**[4], **Minoru Yamada**[5], **Rei Ono**[1]
[1]Kobe University Graduate School of Health Science, [2]National Center for Geriatrics and Gerontology, [3]Kobe City Hospital Organization Kobe City Medical Center West Hospital, [4]Kobegakuin University Faculty of Rehabilitation, [5]Kyoto University Graduate School of Medicine

**P2-N-227 Interference of the Stroop test with concurrent postural sway**
***Yoshifumi Ikeda***[1], **Hideyuki Okuzumi**[1], **Mitsuru Kokubun**[1], **Koichi Haishi**[2]
[1]Tokyo Gakugei University, [2]Joetsu University of Education

**P2-N-229 The effect of divided attention on axial plane trunk kinematics during locomotion in healthy young adults and persons with a history of recurrent low back pain**
***Jo Armour Smith***[1], **Kornelia Kulig**[1]
[1]University of Southern California

**P2-N-231 Spatial versus non-spatial cognitive task effects on walking stability in older adults**
***Jasmine Menant***[1], **Daina Sturnieks**[1], **Matthew Brodie**[1], **Joanne Lo**[1], **Stephen Lord**[1]
[1]Neuroscience Research Australia

**P2-N-233 Rule for scaling shoulder rotation angles while walking through apertures**
***Takahiro Higuchi***[1]
[1]Tokyo Metropolitan University

**P2-N-235 Increasing internal focus of attention increases body sway and decreases cortical activities during quiet standing in young healthy adults**
***Kozo Ueta***[1], **Hideki Nakano**[1], **Michihiro Osumi**[1], **Shu Morioka**[1]
[1]Kio University

**P2-N-237 Self-Immersion and Visual Angle Impact Temporal Gait Characteristics during Treadmill Walking**
***Chun-Kai Huang***[1], **Ka-Chun Siu**[1]
[1]University of Nebraska Medical Center

## O - Modeling, robotics and biomechanics and implantable neuroprosthesis

**P2-O-239 Coordination between the stance and swing leg in perturbed walking**
***Takahiro Kagawa***[1], **Yoji Uno**[1]
[1]Nagoya University

**P2-O-241 Adjustment of the angle of attack during human walking on sloped surfaces**
**Kei Tsunoda**[1], ***Naomichi Ogihara***[1]
[1]Keio University

**P2-O-243 Motion analysis of hydraulic leg press machine for elder people**
***Shu-Zon Lou***[1], **Chiun-Ling Chen**[1], **Jin-San Ho**[2], **Ya-Yuan you**[3], **Yu-Chi Chen**[4]
[1]Chung Shan Medical University, [2]National Taiwan Sport University, [3]I-Shou University, [4] China Medical University

**P2-O-245 Effects of weight bearing on the kinematic change of the mid and hind foot**
***Yasuhiko Hatanaka***[1], **Takaaki Nakamata**[1], **Koichi Saito**[1]
[1]Suzuka University of Medical Science

**P2-O-247 Pennation angles of ankle dorsiflexor and plantarflexor muscles depending on the muscle contraction intensity and ankle angles.**
***Seunghyeon Kim***[1], **Jongsang Son**[1], **Youngho Kim**[1]
[1]Yonsei University

**P2-O-249 Effects of an objective function on adjustment of muscle model parameters**
***Jongsang Son***[1], **Seunghyeon Kim**[1], **Youngho Kim**[1]
[1]Yonsei University

**P2-O-251 A differential games approach to study spatial navigation in the presence of dynamic obstacles**

***Anuja Darekar***[1], **Valery Goussev** [2], **Bradford McFadyen**[3], **Anouk Lamontagne**[1], **Joyce Fung**[1]
[1]McGill University, [2]Feil & Oberfeld CRIR Research Center, Jewish Rehabilitation Hospital, [3]Université Laval

**P2-O-253 Testing the natural-synergy control concept on a human-inspired biped robot**

***Georg Hettich***[1], **Alexey Alexandrov**[2], **Alexander Frolov**[2], **Thomas Mergner**[1]
[1]University Freiburg, [2]Inst. of Higher Nervous Activity and Neurophysiology

## P - Habilitation and rehabilitation; Cognitive, attentional and emotional influences

**P2-P -255 Interpersonal Computer Game Enhance Performance and Motivation of Chronic Stroke Patients to Practice Balance Skill**

***Sanandunk Koonsiripiboon***[1], **Prakarnkiat Youngkong**[1]
[1]King Mongkut's University of Technology Thonburi,

**P2-P -257 Training to walk amid uncertainty with Re-Step: measurements and changes with perturbation training for hemiparesis and cerebral palsy**

***Simona Bar-Haim*** [1]
[1]Ben-Gurion University

**P2-P -259 High muscle tone increases ipsilateral cortical excitability in healthy subjects**

***Akihiro Matsuura***[1], **Tetsuya Karita**[1], **Naoyuki Nakaso**[1], **Yoshihiro Kondo**[1], **Futoshi Mori**[2]
[1]Daisen Rehabilitation Hospital, [2]Yamaguchi University

**P2-P -261 The effect of the biomechanical technique of gait correction for patients with central hemiparesis syndrome after stroke**

***Maria Abroskina***[1], **Semen Prokopenko**[1], **Vitaliy Lytnev**[1], **Vera Ondar**[1], **Elvira Gasymly**[1]
[1]Krasnoyarsk State Medical University

**P2-P -263 Effect of Transcranial Direct Current Stimulation (tDCS) on Protective Stepping Response in Parkinson's Disease**

***Pei-Yun Lee***[1], **Kris Gadareh**[1], **Adolfo Bronstein**[1]
[1]Imperial College London

**P2-P -265 Attitudes and adherence to home-based dual task gait training using MP3 players in PD patients**

***Liesbeth Munks***[1], **Carolien Strouwen**[1], **Pieter Ginis**[1], **Samyra Keus**[2], **Esther Molenaar**[2], **Marten Munneke**[2], **Alice Nieuwboer**[1]
[1]KULeuven, [2]Radboud University

**P2-P -267 Gait abnormalities after stroke: beyond the hemiparesis**

***Olga Dobrushina***[1], **Pavel Snopkov**[1], **Irina Sidyakina**[1], **Tatiana Shapovalenko**[1], **Konstantin Lyadov**[1]
[1]Treatment and Rehabilitation Center

**P2-P -269 A comparison of the kinematics and kinetics of overground walking and a functional mobility task in healthy subjects**

***Shintarou Kudo***[1], **Yasuhiko Hatanaka**[1], **Ippei Yasuda**[2], **Tatsuya Naruse**[2], **Kyoko Fujiwara**[2], **Takanori Sato**[3]
[1]Graduate school of Suzuka University of Medical Science, [2]International Institute of Medical Therapy, [3]Wagounosato of Elderly Healthcare Facility

## Q - Cognitive impairments; Aging

**P2-Q-271 Cerebral correlates of gait impairment in mild cognitive impairment**

***Andreas Zwergal***[1], **Florian Schöberl**[1], **Guoming Xiong**[1], **Katharina Bürger**[1], **Christian La Fougere**[1], **Klaus Jahn**[1]
[1]University of Munich

**P2-Q-273 Effects of Dual-Task Training in Older Adults with Cognitive Impairment: A Case Series Study**

***Ka-Chun Siu***[1], **Shannon Roth**[1], **Chun-Kai Huang**[1], **Dawn Venema**[1]
[1]University of Nebraska Medical Center

**P2-Q-275 Association between performance on Timed Up and Go sub-tasks and Mild Cognitive Impairment: Further insights into the cognitive aspects of the TUG**

***Anat Mirelman***[1], **Aner Weiss**[1], **Aron Buchman**[2], **David Bennett**[2], **Nir Giladi**[1], **Jeffrey Hausdorff**[1]
[1]Tel Aviv Sourasky Medical Center, [2]Rush Alzheimer's Disease Center, Rush University Medical Center

**P2-Q-277 Balance performance across three stages of cognitive impairment and Alzheimer's disease**

***Gro Tangen***[1], **Knut Engedal**[2], **Astrid Bergland**[3], **Anne Marit Mengshoel**[1]
[1]University of Oslo, [2]Norwegian Center for Ageing and Health, [3]Oslo and Akershus University College of Applied Sciences

## R - Development of posture and gait; Coordination of posture and gait

**P2-R-279 Visual Height Intolerance: Gaze Behavior at Upright Stance**

***Thomas Brandt***[1]
[1]Clinical Neurosciences

**P2-R-281 Adjustments of the kinematic gait parameters during pregnancy**

***Wanda Forczek***[1], **Yuri Ivanenko**[2]
[1]University School of Physical Education in Krakow, [2]IRCCS Fondazione Santa Lucia

**P2-R-283 A functional approach to learning to walk: a longitudinal study**

***Blandine Bril***[1], **Lucile Dupuy**[1], **Gilles Dietrich**[2], **Daniela Corbetta**[3]
[1]Ecole des Hautes Etudes en Sciences Sociales, [2]Techniques et Enjeux du Corps, Université Paris Descartes, [3]University of Tennessee

**P2-R-285 Developmental change in variability of rolling over from supine to prone position in infants**

***Yoshio Kobayashi***[1], **Hama Watanabe**[1], **Gentaro Taga**[1]
[1]Graduate School of Education, The University of Tokyo

**P2-R-287 Postural control and visual information in children with cerebral palsy**

***Ana Barela***[1], **Melissa Celestino**[1], **Karyna Trindade**[1], **Jose Barela**[1]
[1]Universidade Cruzeiro do Sul

**P2-R-289 Walking and running gait in children with Developmental Coordination Disorder**

***Susan Morris***[1], **Jenny Downs**[2], **Nicola Diamond**[1]
[1]Curtin University, [2]Institute for Child Health Research

**P2-R-291 Factors affecting performance of tray-carrying task in children with intellectual disabilities**

***Shogo Hirata***[1], **Hideyuki Okuzumi**[2], **Yoshio Kitajima**[1], **Tomio Hosobuchi**[3], **Mitsuru Kokubun**[2]
[1]Chiba University, [2]Tokyo Gakugei University, [3]Saitama University

## S - Effect of medication on posture and gait; Falls and falls prevention

**P2-S-293 Effect of pedunculopontine nucleus stimulation at low frequency on gait and balance disorders in advanced Parkinson's disease**

***Adèle Demain***[1], **Claire Ewenczyk**[1], **Marie-Laure Welter**[1], **Amine El Helou**[1], **Brian Lau**[2], **Chantal François**[2], **Carine Karachi**[2], **David Grabli**[1]
[1]CR-ICM 1er étage CIC, [2]CR-ICM 5ème étage CIC

**P2-S-295 Dyskinesia detection and monitoring by means of a single inertial sensor in patients with Parkinson's Disease**

***Sabato Mellone***[1], **Giovanna Lopane**[1], **Manuela Contin**[1], **Lorenzo Chiari**[1]
[1]University of Bologna

**P2-S-297 Effect of chemodenervation of the rectus femoris muscle in adults with a Stiff Knee Gait due to Spastic paresis : A systematic review with a meta analysis in Stroke patients.**

***Martin Tenniglo***[1], **Marc Nederhand**[1], **Erik Prinsen**[1], **Anand Nene**[1], **Hans Rietman**[1], **Jaap Buurke**[1]
[1]Roessingh Research & Development

## T - Ergonomics; Aging

**P2-T-299 The effects of floor material, surface condition, and repetition on gait during walking**

***Chien-Chi (Max) Chang***[1], **Mary Lesch**[1], **Wen-Ruey Chang**[1]
[1]Liberty Mutual Research Institute for Safety

## U - Psychiatric disorders; Vestibular function and disorders

**P2-U-301 Psychiatric comorbidity in patients with dizziness**

***Kensuke Kiyomizu***[1], **Keiji Matsuda**[2], **Koji Torihara**[3], **Meiho Nakayama**[4], **Shinji Fukudome**[2], **Shinya Sato**[3], **Takeshi Nakamura**[5], **Yasushi Ishida**[2], **Kensei Yoshida**[1], **Tetsuya Tono**[2]
[1]Yoshida Hospital , [2]Faculty of Medicine, University of Miyazaki, [3]Miyazaki prefectural Nobeoka Hospital, [4]Nagoya City University, [5]Miyakonojo National Hospital

# Poster Session 3 PINK

**Tuesday, June 25 between 10:00 and 12:00**

## L - Falls and falls prevention; Aging

**P3-L-152 Analysis Of 857 Cases With In-Hospital Falls**

***Hiroyuki Harada***[1], **Yasushi Naito**[1], **Shyougo Shinohara**[1], **Keizou Fujiwara**[1], **Masahiro Kikuchi**[1], **Yuuji Kanazawa**[1], **Risa Tona**[1], **Ippei Kishimoto**[1]
[1]Kobe City Medical Center General Hospital, Japan

**P3-L-154 Using Motion Analysis in Single Leg Standing Task to Predict Fall Risk for the Elderly**

***Chun-Ju Chang***[1], **Yu-Shin Chang**[1], **Sai-Wei Yang**[1]
[1]Deparment of Biomedical Engineering, National Yang-Ming University

**P3-L-156 Biomechanical Balance Parameters In Frontal Plane Predict Prospective Falls In Elderly Adults**

***Tzurei Chen***[1], **Li-Shan Chou**[2]
[1]University of Evansville, [2]University of Oregon

**P3-L-158 Falls-associated parameters in a cohort of 641 elderly- the TREND study**

***Sandra Hasmann***[1], **Markus Hobert**[1], **Jochen Klenk**[2], **Benjamin Röben**[1], **Jana Godau**[1], **Clemens Becker**[2], **Daniela Berg**[1], **Walter Maetzler**[1]
[1]University of Tuebingen, [2]Robert-Bosch-Krankenhaus

**P3-L-160 Effect of a plantar perceptual learning task on walking stability in the elderly: a randomized controlled trial**

***Hideki Nakano***[1], **Makoto Nozaki**[2], **Kozo Ueta**[1], **Michihiro Osumi**[1], **Seigou Kawami**[3], **Shu Morioka**[1]
[1]Graduate School of Health Science, Kio University, [2]Medicare Rehabilitation Corporation, [3]Higashi Osaka Yamaji Hospital

**P3-L-162 Risk Factors for Head Impact during Falls in Older Adults Residing in Long-Term Care**

***Yijian Yang***[1], **Dawn Mackey**[1], **Teresa Liu-Ambrose**[2], **Stephen Robinovitch**[1]
[1]Simon Fraser University, [2]University of British Columbia

**P3-L-164 The complexity of standing postural control in older adults: A modified detrended fluctuation analysis based upon the empirical mode decomposition algorithm**

***Junhong Zhou***[1], **Brad Manor**[2], **Dongdong Liu**[1], **Kun Hu**[3], **Jue Zhang**[1], **Jing Fang**[1]
[1]Peking University, [2] Harvard Medical School, [3] Brigham and Women's Hospital/ Harvard Medical School

**P3-L-166 Risky gaze behaviour adopted by older adults during virtual walking is linked to cognitive decline**

***Mark Hollands***[1], **Jennifer Stanley**[2]
[1]Liverpool John Moores University, [2]University of Birmingham

**P3-L-168 Slow walking as a strategy for optimizing performance on cognitive task during dual task walking.**

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

**P3-L-170 Distribution of gray matter atrophy in older people with concern about falling: A voxel-based morphometric study**

***Kim Delbaere***[1], **Carola Tuerk**[1], **Haobo Zhang**[1], **Wei Wen**[1], **Stephen Lord**[1], **Jacqueline Close**[1], **Henry Brodaty**[1], **Perminder Sachdev**[1]
[1]University of New South Wales

**P3-L-172 Influence of Parkinson's disease on segmental coordination during turning with and without vision**

***Sakineh Akram***[1], **James Frank**[1], **Mandar Jog**[2]
[1]University of Waterloo, [2]Movement Disorders Clinic, London Health Sciences Centre

**P3-L-174 An examination of dynamic momentum control during gait using regions of stability**

***Masahiro Fujimoto***[1], **Li-Shan Chou**[2]
[1]University of Maryland School of Medicine, [2]University of Oregon

**P3-L-176 Learning by doing: can perception of affordance for aperture crossing be improved immediately after experience in actual passage?**

***Masaaki Yasuda***[1], **Takahiro Higuchi**[1]
[1]Tokyo Metropolitan University

**P3-L-178 Neuropsychological, balance and gait risk factors for falls in people with multiple sclerosis: a prospective cohort study**

***Stephen Lord***[1], **Phu Hoang**[1], **Simon Gandevia**[1], **Michelle Cameron**[2]
[1]Neuroscience Research Australia, [2]Department of Neurology, Oregon Health & Science University

**P3-L-180 Investigating the relationship between fatigue, balance and walking in people with Multiple Sclerosis**

***James McLoughlin***[1], **Christopher Barr**[1], **Daina Sturnieks**[2], **Maria Crotty**[1], **Stephen Lord**[2]

[1]Flinders University, [2]UNSW

**P3-L-182 Falls and fractures in Parkinson's disease: study of sun exposure time and bone metabolism markers**

***Tetsuya Maeda***[1], **Ken Nagata**[1], **Yuichi Satoh**[1], **Takashi Yamazaki**[1], **Daiki Takano**[1]

[1]Research Institute for Brain and Blood Vessels

**P3-L-184 Dynamic eye movement models provide insight into how fall prevention improves motor control in aging**

***Olivier Coubard***[1]

[1]CNS-Fed

## M - Neurological diseases; Coordination of posture and gait

**P3-M -186 Spatial hyperschematia without spatial neglect after insulo-thalamic disconnection**

***Arnaud Saj***[1], **Juliane Wilcke**[2], **Markus Gschwind**[3], **Héloïse Emond**[1], **Frédéric Assal**[1]

[1]University Hospital of Geneva, [2]University of Geneva, [3]Vaudois University Center Hospital

**P3-M -188 Slowed afferent conduction time contributes to postural instability in patients with hereditary spastic paraplegia**

***Jorik Nonnekes***[1], **Mark de Niet**[1], **Lars Oude Nijhuis**[1], **Susanne de Bot**[1], **Bart van de Warrenburg**[1], **Bastiaan Bloem**[1], **Alexander Geurts**[1], **Vivian Weerdesteyn**[1]

[1]Radboud University Medical Centre, Nijmegen

**P3-M -190 Evaluation of the Reliability of a Questionnaire for Gait Disorders in Parkinson's Disease Patients**

***Hana Brozova***[1], **Martina Hoskovcova**[1], **Petr Dusek**[1], **Katerina Zarubova**[1], **Robert Jech**[1], **Jan Roth**[1], **Jan Rusz**[1], **Evzen Ruzcika**[1]

[1]Charles University in Prague, 1st Faculty of Medicine

**P3-M -192 Gait instability measured by dual task gait test and leukoaraiosis**

***Bernard Auvinet***[1], **Claude Touzard**[2], **Celine Foucher**[1], **Arnaud Delafond**[1]

[1]Polyclinique du Maine, [2]Hospital LAVAL

**P3-M -194 Executive function relates to specific gait and balance metrics in Parkinson's disease**

***Martina Mancini***[1], **Rajal Cohen**[2], **Krystal Klein**[1], **John Nutt**[1], **Fay Horak**[2]

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

**P3-M-196 Inhibitory Deficits Are Associated With Freezing of Gait in Parkinson's Disease**

***Rajal Cohen***[1], **Mari Nomura**[2], **Krystal Klein**[2], **Michael Fleming**[2], **Martina Mancini**[2], **Jay Nutt**[2], **Fay Horak**[2]

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

**P3-M -198 Subcortical and cortical contributions to posture and movement planning and preparation for forward reaching in standing post stroke.**

***Sandy McCombe Waller***[1], **Andrea Gaeta**[2], **Chieh-ling Yang**[2], **Larry Magder**[2], **Mark Rogers**[2]

[1]University of Maryland School of Medicine, [2]University of Maryland

**P3-M -200 Imposing asymmetry through split-belt walking in patients Parkinsons disease**

***Farshid Mohammadi***[1], **Sabine Verschueren**[1], **Sjoerd Bruin** [1], **Alice Nieuwboer**[1]

[1]KU Leuven

**P3-M -202 The validity of sensor-based gait assessment in Parkinsons Disease**

***Pieter Ginis***[1], **Alberto Ferrari**[2], **Laura Rocchi**[2], **Lorenzo Chiari**[2], **Alice Nieuwboer**[1]

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

**P3-M -204 Abnormal external oblique muscle activity in camptocormic patients with Parkinson's disease**

***Yoshihiko Furusawa***[1], **Aihara Yuri**[1], **Yasuyuki Iwata**[1], **Tomoya Taminato**[1], **Yohei Mukai**[1], **Tomohiko Takei**[1], **Takashi Hanakawa**[1], **Takashi Sakamoto**[1], **Miho Murata**[1]

[1]National Center Hosptail, National Center of Neurology and Psychiatry

**P3-M -206 Gait adaptability training improves obstacle avoidance capacities and dynamic stability in patients with degenerative cerebellar ataxia**

***Vivian Weerdesteyn***[1], **Ella Fonteyn**[1], **Anita Heeren**[1], **Jasper-Jan Engels**[1], **Jasper Den Boer**[1], **Bart Van de Warrenburg**[1]

[1]Radboud University Medical Centre

**P3-M -208 The neural network learning functional electrical stimulation (FES) for the correction of drop-foot in hemiplegia**

***Toshiki Matsunaga***[1], **Yoichi Shimada**[2], **Takenori Tomite**[2], **Kimio Saito**[2], **Takehiro Iwami**[3]

[1]Akita University Hospital, [2]Akita University Graduate School of Medicine, [3]Akita University Faculty of Engineering and Resource Science

**P3-M -210 Dynamic postural control under visual constraint in post-stroke hemiplegic patients**

***Yuko Kuramatsu***[1], **Yuji Yamamoto**[2], **Shin-Ichi Izumi**[1]

[1]Tohoku University, [2]Nagoya University

**P3-M -212 Understanding Balance Differences in Multiple Sclerosis: An Investigation of Differences in Sensory Feedback on Stability**

***Luke Denomme***[1], **Michael Cinelli**[1]

[1]Wilfrid Laurier University

## N - Cognitive, attentional and emotional influences; Sensorimotor control

**P3-N-214 Estimating Mood from MPF of EMG during Walking**

***Yuta Kinase***[1], **Gentiane Venture**[1]

[1]Tokyo University of Agriculture and Technology

**P3-N-216 Stance stability can affect imagined arm movements.**

***Hayley Boulton***[1], **Subhobrata Mitra**[1]

[1]University of Warwick

**P3-N-218 Fear Of Falling And Multi-Tasking During Stair Descent In Community Dwelling Older Women**

***Bradford McFadyen***[1], **Sophie Blanchet**[1], **Constantinos Maganaris**[2], **Bill Baltzopolous**[3]

[1]CIRRIS-U. LAVAL, [2]Manchester Metropolitan University, [3]Brunel University

**P3-N-220 Investigating the cognitive processes underlying gait and falls in young and older healthy adults: Returning to an executive model.**

***Elizabeth Walshe***[1], **Richard A. P. Roche**[1], **Sean Commins**[1]

[1]National University of Ireland Maynooth

**P3-N-222 Effects of attentional focus on imagery and execution of sit-to-stand movements in healthy young and older adults**
***Kanokwan Srisupornkornkool***[1], **Suvobrata Mitra**[1]
[1]University of Warwick

**P3-N-224 Cognitive decline is associated with impairments in mobility in healthy older adults: findings from a 5 year prospective study**
***Shirley Shema***[1], **Roy Tzemah**[1], **Marina Brozgol**[1], **Talia Herman**[1], **Nir Giladi**[1], **Anat Mirelman**[1], **Jeffrey Hausdorff**[1]
[1]Tel Aviv Sourasky Medical Center

**P3-N-226 Dual tasking affects lateral trunk control in healthy younger and older adults**
***Tsuyoshi Asai***[1], **Takehiko Doi**[2], **Soichiro Hirata**[3], **Hiroshi Ando**[4]
[1]Kobegakuin University, [2]National Center for Geriatrics and Gerontology, [3]Higashihirosima Orthopedic clinic , [4]Kobe University

**P3-N-228 Stepping accuracy of walking measured using a cancellation task**
***Ryotaro Saito***[1], **Yoshifumi Ikeda**[1], **Yoshimi Nakajima**[1], **Hideyuki Okuzumi**[1]
[1]Tokyo Gakugei University

**P3-N-230 Relationship between visual influence on path integration and landmark navigation ability**
***Kishiko Sunami***[1], **Hidifumi Yamamoto**[1], **Yuki Kouda**[1], **Naohiro Tsuyuguchi**[1], **Hideo Yamane**[1]
[1]OsakaCityUniversity

**P3-N-232 Awareness of visual reliability significantly influences the relative sensory weight on motion perception under sensory conflict condition**
***Sue Park***[1], **Hyeob Choi**[1]
[1]KAIST

**P3-N-234 Dual-task effect on proprioceptive target-matching task by young healthy individuals**
***Kazuhiro Yasuda***[1], **Yuki Sato**[1], **Naoyuki Iimura**[1], **Hiroyasu Iwata**[1]
[1]Waseda University

**P3-N-236 The acute effects of transcranial direct current stimulation (tDCS) on balance and cerebral perfusion in young adults**
***Brad Manor***[1], **Junhong Zhou**[2], **Hao Ying**[1], **Alvaro Pascual-Leone**[1], **Jue Zhang**[1]
[1]Harvard Medical School, [2]Peking University

## O - Modeling, robotics and biomechanics and implantable neuroprosthesis; Coordination of posture and gait

**P3-O-238 Human Balance Control during Walking on Compliant Ground**
***Kenji Hashimoto***[1], **Egidio Falotico**[2], **Atsuo Takanishi**[1], **Cecilia Laschi**[2], **Paolo Dario**[2], **Alain Berthoz**[3]
[1]Waseda University, [2]Scuola Superiore Sant'Anna, [3]College de France

**P3-O-240 Structural analysis of trajectory variances in walking task with obstacles**
***Davide Zambrano***[1], **Colas Authié**[2], **Cecilia Laschi**[1], **Alain Berthoz**[2], **Daniel Bennequin**[3]
[1]Scuola Superiore Sant'Anna, [2]Collège de France - CNRS, [3]Institut de Mathématiques de Jussieu

**P3-O-242 Squatting, a universal posture that minimizes instability: modelling and simulation of reaction to disturbance when squatting and standing**
***Gilles Dietrich***[1], **Lena Ferrufino**[2], **Blandine Bril**[2]
[1]Université Paris Descartes, [2]Ecole des Hautes Etudes en Sciences Sociales

**P3-O-244 Differences in the fall responses of sedentary subjects versus contact and noncontact sportsmen due to tendon vibration at different sensory conditions**
**Ozan Cinar**[1], **Emre Akcay**[1], **Ahmet Yildirim**[1], ***Senih Gurses***[1]
[1]Middle East Technical University

**P3-O-246 Efficacy of the robot suit HAL in a hemiplegic client**
***Toru Takeda***[1], **Eriko Sudo**[1], **Misao Nakazawa**[1]
[1]Akita Prefectural Center for Rehabilitation and Psychiatric Medicine

**P3-O-248 Contact force on the medial knee joint and knee function in the elderly: An inverse simulation analysis of gait**
***Shinya Ogaya***[1], **Hisashi Naito**[2], **Akira Iwata**[1], **Yumi Higuchi**[1], **Satoshi Fuchioka**[1], **Masao Tanaka**[2]
[1]Osaka Prefecture University, [2]Osaka University

**P3-O-250 Decomposition Method for Dynamic Posturographic Data**
***Emre Akçay***[1], **Senih Gürses**[1], **Kemal Özgören**[1]
[1]Middle East Technical University

**P3-O-252 The Digits Force during Cylindrical Grasp in Natural and Constrained Grasp**
***You-Hua Su***[1], **Po-Tsun Chen**[1], **Li-Chieh Kuo**[1], **Fong-Chin Su**[1]
[1]National Cheng Kung University

## P - Habilitation and rehabilitation; Coordination of posture and gait

**P3-P -254 Immediate beneficial effects of a mental rotation of foot stimuli for upright postural control in young healthy participants**
***Tsubasa Kawasaki***[1], **Kazuhiro Yasuda**[2], **Takahiro Higuchi**[1]
[1]Tokyo Metropolitan University, [2]Waseda University

**P3-P -256 Positive and negative effects of support by upper limbs on performance accuracy of lateral body weight-shifting**
***Miyoko Watanabe***[1], **Takahiro Higuchi**[1], **Kuniyasu Imanaka**[1]
[1]Tokyo Metropolitan University

**P3-P -258 Aftereffect of gait exercise using functional electrical stimulation in hemiplegic patients**
***Maegawa Ryouta***[1], **Hatanaka Yasuhiko**[1], **Nakamata Takaaki**[1], **Saito Kouichi**[1], **Ito Kazuhiro**[1], **Kitagawa Yuka**[1], **Uno Yukiko**[1], **Kitagawa Megumi**[1], **Tamura Kimiyosi**[1]
[1]Graduate School Medical Science, Suzuka University of Medical Science/ Rehabilitation center Oumionsen Hospital

**P3-P -260 Balance and cognitive reactivation for patients with atactic disorder during recovery stroke period**
***Maria Abroskina***[1], **Semen Prokopenko**[1], **Vitaliy Lytnev**[1], **Svetlana Kaygorodceva**[1], **Maria Turchenko**[1]
[1]Krasnoyarsk State Medical University

**P3-P -262 Assessment of the balance and gait functions in patients with the syndrome of central hemiparesis after stroke**
***Maria Abroskina***[1], **Vera Ondar**[1], **Semen Prokopenko**[1], **Vitalyi Lytnev**[1], **Vera Vlasova**[1]
[1]Krasnoyarsk State Medical University

**P3-P -264 The effect of gait speed on gait variability and asymmetry in children and adolescents with Cerebral Palsy**

***Siri Braendvik***[1], **Tobias Goihl**[3], **Beatrix Vereijken**[2]
[1]St. Olav's University Hospital, [2]Norwegian University of Science and Technology, [3]Trøndelag Orthopedic Workshop

**P3-P -266 Effects of Clock-Turning Pattern on Gait Performance in People with Parkinson Disease**

***Wen-Chieh Yang***[1], **Kwan-Hwa Lin**[1], **Wei-Li Hsu**[1], **Ruey-Meei Wu**[3], **Tung-Wu Lu**[2]
[1]College of Medicine, National Taiwan University, [2]National Taiwan University, [3]National Taiwan University Hospital, College of Medicine, National Taiwan University

**P3-P -268 The process of brake reaction time and knee functional test for patients with total knee arthroplasty**

***Jing-Min Liang***[1], **Wen-Lan Wu**[1], **Hsuan-Ti Huang**[1], **Wei-Tso Hung**[1]
[1]kaohsiung Medical University

## Q - Cognitive impairments; Aging

**P3-Q-272 Further evidence for the co-dependence of cognitive function and mobility in aging: findings from a 5 year prospective study**

***Roy Tzemah***[1], **Shirley Shema**[1], **Talia Herman**[1], **Marina Brozgol**[1], **Nir Giladi**[1], **Anat Mirelman**[1], **Jeffrey Hausdorff**[1]
[1]Tel Aviv Sourasky Medical Center

**P3-Q-274 Disability in Instrumental Activities of daily living in elderly patients with Mild Cognitive Impairment or Alzheimers disease**

***Karin Hesseberg***[1], **Astrid Bergland**[1], **Hege Bentzen**[2], **Anette Hylen-Ranhoff**[2], **Knut Engedal**[3]
[1]Oslo and Akershus University College, [2]Diakonhjemmet Hospital, [3]Faculty of medicine, University of Oslo

**P3-Q-276 Quantitative gait parameter changes in good and poor Trail Making Test performers under challenging single and dual tasking conditions: Cross-sectional analysis in 673 elderly**

***Markus Hobert***[1], **Sinja Meyer**[1], **Raphael Niebler**[2], **Alexandra Gaenslen**[1], **Kathrin Brockmann**[1], **Isabel Wurster**[1], **Gerhard Eschweiler**[2], **Daniela Berg**[1], **Walter Maetzler**[1]
[1]Center of Neurology, University of Tuebingen, [2]University Hospital Tuebingen

**P3-Q-278 Long-term effects of concussion on a collision avoidance task**

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

## R - Development of posture and gait; Coordination of posture and gait

**P3-R-280 Effect of icing lower-leg muscle during walking on irregular surface**

***Akira Obara***[1], **Shiina Takayuki**[1], **Takemura Hiroshi**[1], **Mizoguchi Hiroshi**[1]
[1]Tokyo University of Science

**P3-R-282 Development of postural control in children involves functional freezing of degrees of freedom**

***Akio Yamamoto***[1], **Shun Sasagawa**[1], **Naoko Oba**[1], **Kimitaka Nakazawa**[1]
[1]University of Tokyo

**P3-R-284 Task-specificity of postural control in patients recovering from stroke**

***Shogo Hiragami***[1], **Tetsushi Nonaka**[1], **Yasuo Suzuki**[2]
[1]Research Institute of Health and Welfare, Kibi International University, [2]Kurashiki Kinen Hospital

**P3-R-286 Assessment of Ankle Joint Stiffness along Various Frequency of Translation Perturbation**

***Aizreena Azaman***[1], **Shin-ichiroh Yamamoto**[1]
[1]Shibaura Institute of Technology

**P3-R-288 Characteristics of gait in adults with intellectual and developmental disabilities**

***Hideyuki Okuzumi***[1], **Yoshifumi Ikeda**[1], **Shogo Hirata**[2], **Mitsuru Kokubun**[1]
[1]Tokyo Gakugei University, [2]Chiba University

**P3-R-290 Motor function in children with Autism Spectrum Disorder: a cross-sectional longitudinal study**

***Nicoleta Bugnariu***[1], **Rita Patterson**[1], **Dan Popa**[2], **Carolyn Garver**[3]
[1]UNT Health Science Center, [2]University of Texas at Arlington, [3]Autism Treatment Center

**P3-R-292 Investigating balance in persons with Down Syndrome: A focus on vision**

***Lisa Bunn***[1], **Jonathan Waddington**[1], **Chris Harris**[1], **Heather Skirton**[1], **Jonathan Marsden**[1]
[1]Plymouth University

## S - Effect of medication on posture and gait; Neurological diseases

**P3-S-294 Next -day residual effects of Zolpidem and Triazolam, Rilmazafone Hydrochloride administered at bedtime: a randomized double-blind study in elderly subjects**

***Sachiko Uemura-Ito***[1], **Masahiko Wakasa**[1], **Akira Saito**[1], **Makoto Sasaki**[1], **Masahiro Satake**[1], **Shunsuke Kudo**[1], **Shinichi Shindo**[1], **Takashi Kanbayashi**[2], **Tetsuo Shimizu**[2], **Takanobu Shioya**[1], **Kyoji Okada**[1]
[1]Akita University Graduate School of Health Sciences, [2]Akita University Graduate School of Medichine

**P3-S-296 Dual task costs of gait in advanced Parkinson's disease improve with L-Dopa but not with deep brain stimulation**

***Markus Hobert***[1], **Lara Paulig**[1], **Rejko Krüger**[1], **Daniel Weiss**[1], **Walter Maetzler**[1]
[1]Center of Neurology, University of Tuebingen

## T - Ergonomics; Tools and methods for posture and gait analysis

**P3-T-298 Is strategy a matter of age?**

***Martine Gilles***[1], **Jean-Charles Guélin** [1], **Pascal Wild**[1]
[1]INRS

**P3-T-300 Biomechanical Changes During Various Cross-Legged Sitting Postures**

***Soonjae Ahn***[1], **Seunghyeon Kim**[1], **Youngho Kim**
[1]Department of Biomedical Engineering and Institute of Medical Engineering, Yonsei University

## U - Psychiatric disorders; Vestibular function and disorders

**P3-U-302 Neuro-otological findings in psychiatric patients with nystagmus**

***Kensuke Kiyomizu***[1], **Keiji Matsuda**[2], **Koji Torihara**[3], **Meiho Nakayama**[4], **Shinji Fukudome**[2], **Shinya Sato**[3], **Takeshi Nakamura**[5], **Yasushi Ishida**[2], **Kensei Yoshida**[1], **Tetsuya Tono**[2]
[1]Yoshida Hospital , [2]Faculty of Medicine, University of Miyazaki, [3]Miyazaki prefectural Nobeoka Hospital , [4]Nagoya City University , [5]Miyakonojo National Hospital

# Poster Session 4 BLUE

**Tuesday, June 25 between 16:30 and 18:30**

## A - Tools and methods for posture and gait analysis

**P4-A-2 Intrasession reliability for measures of variability in gait**

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

**P4-A-4 Towards automated detection of freezing of gait during community ambulation? Further investigation of the FoG index**

***Eran Gazit***[1], **Ariel Tankus**[1], **Tal Freedman**[1], **Talia Herman**[1], **Inbal Maidan**[1], **Nir Giladi**[1], **Anat Mirelman**[1], **Jeffrey Hausdorff**[1]
[1]Tel aviv sourasky medical center

**P4-A-6 Trunk sway measurements during turning while walking in healthy adults**

***Naofumi Tanaka***[1], **Ryushin Hashiba**[2], **Ryota Tobishima**[2], **Hiroko Saito**[2], **Asako Hirayama**[2], **Yoshihiro Muraoka**[3], **Shin-Ichi Izumi**[1]
[1]Tohoku University Graduate School of Medicine, [2]Medical Court Hachinohe West Hospital, [3]Faculty of Human Sciences, Waseda University

**P4-A-8 Correlation between Stabilometry and Electronystagmogram in Patients with Dizziness**

***Hiroko Torii***[1], **Mami Matsunaga**[1], **Kyoko Shimizu**[1], **Akiko Taura**[1], **Kazuo Funabiki**[2], **Juichi Ito**[1]
[1]Kyoto University, [2]Osaka Bioscience Institute

**P4-A-10 Quantitative Evaluation of Stroke Hemiplegic Gait Using Principle Component Analysis**

***Yoshitaka Otani***[1], **Osamu Aoki**[2], **Tomohiro Hirota**[3], **Masahito Murakami**[1], **Yuri Inoue**[1], **Masayuki Uesugi**[1], **Junichi Kato**[4], **Hiroshi Ando**[5]
[1]Faculty of Rehabilitation/Kobe International University, [2]Faculty of Rehabilitation/Shijonawate Gakuen University, [3]Department of Rehabilitation/Hyogo Prefectural Rehabilitation Hospital at Nishi-Harima, [4]Department of Internal Medicine/Hyogo Prefectural Rehabilitation Hospital at Nishi-Harima, [5]Faculty of Health Science/Kobe University Graduate School

**P4-A-12 Study of the stability in time of marksmen**

***Pierre-Marie Gagey***[1], **Raoul Dudde**[2], **Maurice Ouaknine**[3], **Bernard Weber**[1]
[1]Institut de Posturologie, Paris, [2]Fédération Française de Tir, [3]Université Méditerrannée

**P4-A-14 Pedography - Dynamic Assessment of Foot Function**

***Holger Neumann***[1]
[1]Novel GMBH

**P4-A-16 The effect of overground walking protocols on the measurement of average gait and gait variability data**

***Chitra lakshmi K Balasubramanian***[1], **Robert Page**[1], **Joe Stoecklein**[1]
[1]University of North Florida

**P4-A-18 Detecting not-wearing periods during activity monitoring in older adults**

***Mirjam Pijnappels***[1], **Martijn Niessen**[2], **Rob van Lummel**[2], **Jaap van Dieën**[1]
[1]VU University, [2]McRoberts

**P4-A-20 The effect of sensory manipulations on mediolateral balance performance.**

***Luis Eduardo Cofré Lizama***[1], **Mirjam Pijnappels**[1], **Jaap van Dieen**[1]
[1]VU University Amsterdam

**P4-A-22 Dual-task effects on smoothness of walking in patients with stroke using power spectrum entropy of trunk acceleration.**

***Yu Inoue***[1], **Shogo Hiragami**[2], **Kazuhiro Harada**[3], **Kojiro Kagawa**[4]
[1]Graduate School of Health and Welfare Science, Okayama Prefectural University, [2]Research Institute of Health and Welfare, KIBI International University , [3]School of Health Science and Social Welfare, KIBI International University, [4]Faculty of Health and Welfare Science, Okayama Prefectural University

**P4-A-24 Gait Patterns of Ambulatory Hemiplegic Elderly**

***Mi Jung Kim***[1], **Junho Kim**[1], **Dohyun Yoon**[1], **Hyunpil Cho**[1], **Seunh Jun Seol**[1], **Sangwon Kong**[1], **Kyung Soo Lee**[1], **Seung young Choi**[1], **Boram Kang**[1], **Dong Hun Lee**[1], **Taikon Kim**[1]
[1]Hanyang University Medical Center

**P4-A-26 High-Pass-Filter Cut-Offs Determination of the Fatigue Index During Isotonic contractions**

**Jungyoon Kim**[1], **Soonjae Ahn**[1], **Youngho Kim**[1]
[1]Yonsei University

**P4-A-28 Gait assessment using desired center of pressure: How robotics concept matches human gait**

***Kei Masani***[1], **Takeshi Yamaguchi**[2], **Hiroshi Onodera**[3]
[1]Toronto Rehabilitation Institute, [2]Tohoku University, [3]National Hospital Organization CREST lab

**P4-A-30 The Effect of Postural Stability by Foot Arch in Older People**

**Emi Anzai**[1], **Kanako Nakajima**[1], **Yumi Iwakami**[2], **Shuichi Ino**[3], **Toru Ifukube**[4], **Kazuhiko Yamashita**[2], **Yuji Ohta**[1]
[1]Ochanomizu University, [2]Tokyo Healthcare University, [3]National Institute of Advanced Industrial Science and Technology, [4]Institute of Gerontology, University of Tokyo

**P4-A-32 A new metric for upright balance**

***Mohammad Hadi Honarvar***[1], **Motomu Nakashima**[1]
[1]Tokyo Institute of Technology

**P4-A-34 Assessing fall risk in Patients with Parkinson's Disease using an instrumented 3-day activity monitoring**

***Aner Weiss***[1], **Talia Herman**[1], **Nir Giladi**[1], **Jeffrey Hausdorff**[1]
[1]Tel Aviv Sourasky Medical Center

**P4-A-36 Role of the human foot in the erect posture**

***Okan Alkan***[1], **Roshanak Akbarifar**[1], **Senih Gurses**[1]
[1]Middle East Technical University

**P4-A-38 Stability and Dynamics of Turn During Walking in People With Parkinson's Disease**

***Martina Mancini***[1], **Sabato Mellone**[2], **Fay Horak**[1], **Ryan Meyer**[1], **John Nutt**[1], **Lorenzo Chiari**[2]
[1]OHSU, [2]University of Bologna,

**P4-A-40 Heterogeneity of postural sensory integration functions in Parkinson disease**

***Martijn Muller***[1], **Roger Albin**[1], **Kirk Frey**[1], **Nicolaas Bohnen**[1]
[1]University of Michigan

**P4-A-42 Effects of Hallux Valgus on the Lower Limb Biomechanics During Walking**

***Kao-Shang Shih***[1], **Hui-Lien Chien**[2], **Chu-Fen Chang**[2], **Tung-Wu Lu**[2]
[1]Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan, [2]Institute of Biomedical Engineering, National Taiwan University

**P4-A-44 The effect on gait asymmetry of treating older hip fracture patients in a geriatric ward as compared to usual care in an orthopedic ward? The Trondheim Hip Fracture trial**

***Pernille Thingstad***[1], **Kristin Taraldsen**[1], **Beatrix Vereijken**[1], **Rolf Moe-Nilssen**[2], **Olav Sletvold**[3], **Jorunn Helbostad**[1]
[1]NTNU, [2]University of Bergen, [3]St. Olav's University Hospital and NTNU

**P4-A-46 Gait performance abnormality in patients with vestibular disorders.**

***Yoshiaki Itasaka***[1], **Kazuo Ishikawa**[1], **Eigo Omi**[1], **Koh Koizumi**[1]
[1]Akita University

**P4-A-48 Three-dimensional analysis of postural control during stepping in patients with unilateral vestibular dysfunction**

***Naoya Egami***[1], **Shinichi Iwasaki**[1], **Chisato Fujimoto**[1], **Tatsuya Yamasoba**[1]
[1]University of Tokyo

## B - Sensorimotor control

**P4-B-50 Altered proprioceptive weighting impairs postural balance in individuals with chronic obstructive pulmonary disease**

***Lotte Janssens***[1], **Simon Brumagne**[1], **Alison McConnell**[2], **Kurt Claeys**[1], **Madelon Pijnenburg**[1], **Nina Goossens**[1], **Jonas Raymaekers**[1], **Chris Burtin**[1], **Wim Janssens**[1], **Marc Decramer**[1], **Thierry Troosters**[1]
[1]KU Leuven, [2]Brunel University

**P4-B-52 Undershooting of target angles in a joint position matching task derives from passive movement in the position memory phase**

***Yuki Sato***[1], **Kazuhiro Yasuda**[1], **Hiroyasu Iwata**[1]
[1]Waseda University

**P4-B-54 Soleus H-reflex is suppressed during unilateral hip and/or knee passive movements in human**

***Yohei Masugi***[1], **Taku Kitamura**[2], **Tetsuya Ogawa**[3], **Noritaka Kawashima**[3], **Kimitaka Nakazawa**[1]
[1]University of Tokyo, [2]Shibaura Institute of Technology, [3]Research Institute of the National Rehabilitation Center for Persons with Disabilities

**P4-B-56 Sensory and cognitive challenge to postural control in older and young adults**

***Kimberly Dockx***[1], **Veerle Van den Bergh**[1], **Bart Malfait**[1], **Sabine Verschueren**[1], **Alice Nieuwboer**[1]
[1]KU Leuven

**P4-B-58 Age-associated differences in global and segmental adaptive locomotor responses: effects of dual-task and suboptimal sensory conditions**

***Patricia Hewston***[1], **Nandini Deshpande**[1]
[1]Queen's University

**P4-B-60 Effects of mismatch of visual and vestibular input to standing and stepping state. - A study using artificially moved 3D visual image triggered with head movement.**

***Tatsuhiko Harada***[1], **Yasuaki Ito**[1], **Tsunemi Kitagawa**[1]
[1]International University of Health and Welfare Atami Hospital

**P4-B-62 Backward Obstacle Avoidance In Young Healthy Adults**

***Jeanet Wichards***[1], **Duysens Jaak**[2], **Bradford McFadyen**[3]
[1]Radboud University, [2]KU-Leuven, [3]CIRRIS-U. LAVAL

**P4-B-64 Control of COP and COG in anticipatory postural adjustments during multi-directional gait initiation**

***Tomonori Sawada***[1], **Masaki Yukimune**[1], **Nobuhiro Kito**[1]
[1]Hiroshima International University

**P4-B-66 Early rate of split-belt adaptation is correlated to somatosensory perception**

***Wouter Hoogkamer***[1], **Zrinka Potocanac**[1], **Daria Uniszkiewicz**[1], **Steve Dierckxsens**[1], **Stephan Swinnen**[1], **Jacques Duysens**[1]
[1]KULeuven

**P4-B-68 Phase modulation of corticospinal excitability for forearm muscle during voluntary leg stepping**

***Taku Kitamura***[1], **Yohei Masugi**[2], **Shin-ichiro Yamamoto**[1], **Kimitaka Nakazawa**[2]
[1]Shibaura Institute of Technology, [2]University of Tokyo

**P4-B-72 Role of the feet during a complex curved path**

***Laura Marazzato***[1], **Cecilia Laschi**[1], **Paolo Dario**[1], **Alain Berthoz**[2], **Colas Authie**[2]
[1]The Biorobotics Institute, [2]Ippa,Umr7152, Cnrs-Collège De France

## C - Exercise and physical activity; Habilitation and rehabilitation

**P4-C-74 Repeated snowboard exercise with conflict between body rotation and delayed visual feedback in the virtual reality world enhances head stability and slalom run performance in the real world in normal young subjects**

***Yoshiro Wada***[1], **Noriaki Takeda**[2], **Kazuyoshi Tsukamoto**[3]
[1]Nara Medical University, [2]University of Tokushima, [3]Kagawa University

**P4-C-76 Life's a Beach! Benefits of walking on sand on gait kinematics in individuals with MS**

***Maayken van den Berg***[1], **Ben Patritti**[2], **Chris Barr**[1], **James McLoughlin**[1], **Maria Crotty**[1]
[1]Flinders University, [2]Repatriation General Hospital

**P4-C-78 Effects of the oriental breathing technique on the center of pressure trajectory while standing**

***Atsushi Itaya***[1], **Tomohiro Kizuka**[1], **Takuro Endo**[1]
[1]University of Tsukuba

**P4-C-80 Evaluation of dual task training on gait and cognitive parameters in elderly idiopathic faller**

***Moran Dorfman***[1], **Talia Herman**[1], **Marina Brozgol**[1], **Shirley Shema**[1], **Aner Weiss**[1], **Anat Mirelman**[1], **Jeffrey Hausdorff**[1]
[1]Movement Disorder Unit, Tel Aviv Sourasky medical center

**P4-C-84 Clinical experience using a 5 week training program that combines a treadmill with virtual reality to enhance gait**
***Shirley Shema***[1], **Pablo Bezalel**[1], **Ziv Sebrelo**[1], **Moran Dorfman**[1], **Orly Wechsler-Yannai**[1], **Nir Giladi**[1], **Jeffrey Hausdorff**[1], **Anat Mirelman**[1]
[1]Tel Aviv Sourasky Medical Center

**P4-C-86 Changes to ankle joint motor patterns after gait exercise: immediate and after effects**
***Koichi Saito***[1], **Ryouta Maegawa**[2], **Kazuhiro Ito**[2], **Takaaki Nakamata**[1], **Yasuhiko Hatanaka**[1]
[1]Suzuka University of Medical Science, [2]Oumionsen Hospital

**P4-C-88 Effectiveness of Resistance Training on Muscle Strength and Physical Function In People With Parkinson's Disease: A Systematic Review And Meta-Analysis**
***Chloe, Lau Ha Chung***[1], **Thilarajah Shamala**[2], **Dawn Tan**[2]
[1]TanTock Seng Hospital , [2]Singapore General Hopsital

**P4-C-90 Strength- versus balance-training to improve postural control in patients with Parkinson's Disease: a randomized rater-blinded trial - preliminary results**
***Christian Schlenstedt***[1], **Jan Raethjen**[1], **Burkhard Weisser**[1], **Günther Deuschl**[1]
[1]Christian-Albrechts-University of Kiel, Germany

**P4-C-92 Functional ability and health in patients with cervical disc disease compared with patients with chronic whiplash associated disorder and healthy people.**
***Anneli Peolsson***[1]
[1]Linköping University

## D - Vestibular function and disorders

**P4-D-94 Standing balance tests to screen for vestibular disorders**
***Helen Cohen***[1], **Ajitkumar Mulavara**[2], **Brian Peters**[3], **Haleh Sangi-Haghpeykar**[1], **Jacob Bloomberg**[4]
[1]Baylor College of Medicine, [2]Universities Space Research Association, [3]Wyle Science, Technology and Engineering Group, [4]NASA/ Johnson Space Center

**P4-D-96 Dizziness, Postural control and Quality of life in patients with Benign Paroxysmal Positional Vertigo (BPPV): A retrospective cohort study**
***Dawn Tan***[1], **Grace Koh**[1], **Geetha Kunasaigaran**[1]
[1]Singapore General Hospital

**P4-D-98 New Three-Dimensional Head Movement Video Image Analysis Technique Using Personal Computer and Public Domain Software**
***Makoto Hashimoto***[1], **Takuo Ikeda**[1], **Hironori Fuji**[1], **Hiroshi Yamashita**[1]
[1]Yamaguchi University

**P4-D-100 Animal study of vestibular-evoked myogenic potentials**
***Yi-Ho Young***[1]
[1]National Taiwan University Hospital

**P4-D-102 New concept of BPPV pathology ""cristolithiasis"" -Otoconia attached on the crista ampullaris-**
***Koji Otsuka***[1], **Mamoru Suzuki**[1], **Miho Negishi**[1], **Taro Inagaki**[1], **Masanori Yatomi**[1], **Ujimoto Konomi**[1], **Takahito Kondo**[1], **Yasuo Ogawa**[1]
[1]Tokyo Medical University

**P4-D-104 Characteristics of verticality in the hemiplegic patients after stroke**
***Atsushi Manji***[1], **Kazu Amimoto**[1], **Osamu Moromochi**[2], **Ryota Uchida**[2], **Mana Okochi**[2]
[1]Tokyo Metropolitan University, [2]Saitama Misato General Rehabilitation Hospital

**P4-D-106 Sleep medicine may cure the Meniere's disease**
***Meiho Nakayama***[1], **Shinichi Kuriyama**[1], **Kayoko Kabaya**[1], **Keiji Takemura**[1], **Shingo Murakami**[1]
[1]Nagoya City University

**P4-D-108 Body image relies on a vestibular sense of the gravito-inertial force field**
***Richard Fitzpatrick***[1], **Brian Day**[2]
[1]Neuroscience Research Australia, [2]University College London

## E - Orthopedic diseases and injuries

**P4-E-110 Effect of Kinesio Taping on EMG Onset in Patellofemoral Pain Syndrome**
***Yi-Wen Chang***[1], **Shr-Ming Li**[1], **Hong-Wen Wu**[1]
[1]National Taiwan University of Physical Education & Sport

**P4-E-112 The effect of hip chondropathy on single-leg balance performance in adults**
***Anna Hatton***[1], **Joanne Kemp**[1], **Sandy Brauer**[1], **Ross Clark**[2], **Kay Crossley**[1]
[1]The University of Queensland, [2]The University of Melbourne

**P4-E-114 The contribution of ankle strategy in balance control for people with ankle fracture**
***Fang-Ching Lin***[1], **Yun Chen Yeh**[1], **Shuya Chen**[1], **Ying-Hao Chen** [1], **Hsiu-Chen Lin**[1], **Horng-Chaung Hsu**[1]
[1]China Medical University, Taiwan,

**P4-E-116 Neuromuscular screening for ACL injury in elite female athletes during a single-leg drop vertical jump**
***Bart Malfait***[1], **Bart Dingenen**[1], **Jos Vanrenterghem**[2], **Filip Staes**[1], **Sabine Verschueren**[1]
[1]Catholic University Leuven, [2]John Moores University

**P4-E-118 Pain intensity is correlated with postural strategies in patients with severe knee osteoarthritis under different sensory conditions.**
***Rogerio Hirata***[1], **Tanja Jørgensen** [1], **Sara Rosager Mortensen**[2], **Lars Arendt-Nielsen**[1], **Henning Bliddal**[2], **Marius Henriksen** [2], **Thomas Graven-Nielsen**[1]
[1]Aalborg University, [2]Copenhagen University Hospital,

## F - Aging

**P4-F-120 Relationship between hip extension and COP forward progression during gait in the elderly**
***Shingo Takashima***[1], **Takehiro Tagawa**[1], **Yusuke Torii**[1], **Masaru Ichikawa**[1], **Tsuyoshi Nishiwaki**[1]
[1]ASICS Corporation

**P4-F-122 Age-related difference of Center of Body Mass Motion during Walking**
***Takaharu Hosoda***[1], **Tomohiro Takahashi**[1], **Shin-ichiro Yamamoto**[1], **Noritaka Kawashima**[2]
[1]Shibaura Institute of Technology, [2]Research Institute of NRCD, Japan

## G - Aging; Coordination of posture and gait

**P4-G-124 Impacts of Muscle Strength and Balance Control on the Component Tasks of the Timed up And Go Test**

***Tzurei Chen***[1], **Li-Shan Chou**[2]
[1]University of Evansville, [2]University of Oregon

**P4-G-126 Effects of aging on relationship between standing balance and two-point discrimination sensation in the plantar area**

***Kazuhiro Chidori***[1], **Keisuke Takeda**[2], **Yuji Yamamoto**[1]
[1]Nagoya University, [2]Hara Neurosurgery Clinic

## H - Coordination of posture and gait

**P4-H-128 Mechanisms underlying four-limb coordination of human walking - preliminary report on a split belt treadmill study**

***Meir Plotnik***[1], **Yotam Bahat**[1], **Vadim Neder**[2], **Yoav Gimmon**[1]
[1]Sheba Medical Center, [2]Holon Institute of Technology

**P4-H-130 Common muscle synergies for balance and walking**

***Lena Ting***[1], **Stacie Chvatal**[1]
[1]Emory University and Georgia Tech

**P4-H-132 Gait characteristics of mild to moderate disabled Parkinson patients**

***Chang-Hwan Kim***[1], **Bee-Oh Lim**[2], **Mi-Young Kim**[1], **Kyu-Sung Kim** [1]
[1]School of Medicine, Inha University, [2]ChungAng University

**P4-H-134 Locomotor-respiratory entrainment is more constrained in low back pain**

***Paul Hodges***[1], **Steven Saunders**[1]
[1]The University of Queensland

## I - Learning, plasticity and compensation; Coordination of posture and gait

**P4-I-136 The effect of age on the adaptation process of gait termination under the repeated optic flow stimulation**

***Suzuyo Okazaki***[1], **Suetaka Nishiike**[1], **Hiroshi Watanabe**[2], **Takao Imai**[1], **Atsuhiko Uno**[1], **Tadashi Kitahara**[1], **Arata Horii**[3], **Takefumi Kamakra**[1], **Yasumitsu Takimoto**[1], **Noriaki Takeda**[4], **Hidenori Inohara**[1]
[1]Osaka University Graduate School of Medicine/Japan, [2]National Institute of Advanced Industrial Science and Technology, [3]Osaka National Hospital, [4]University of Tokushima Faculty of Medicine

**P4-I-138 Role of the cerebellum and supplementary motor cortex in postural control during gait initiation in healthy adults: a pilot study**

***Alienor Richard***[1], **Amine El Helou**[2], **Sabine Meunier**[1], **Marie-Laure Welter**[2]
[1]CR-ICM, UMRS 7225, Groupe Hospitalier Pitié-Salpêtrière, [2]ICM Fundation, Groupe Hospitalier Pitié-Salpêtrière

**P4-I-140 Postural control adaptation during a repeated load release task**

***Hiroshi Saito***[1], **Masanori Yamanaka**[1], **Satoshi Kasahara**[1]
[1]Faculty of Health Sciences, Hokkaido University

## J - Activity Monitoring; Cognitive, attentional and emotional influences

**P4-J-142 Number of days of trunk acceleration measurements to reliably assess the amount of daily walking in older adults**

***Kimberley van Schooten***[1], **Sietse Rispens**[1], **Petra Elders**[1], **Paul Lips**[1], **Jaap van Dieen**[1], **Mirjam Pijnappels**[1]
[1]VU University

**P4-J-144 The effect of early Parkinsons disease on daily ambulatory activity**

***Sue Lord***[1], **Brook Galna**[1], **Alan Godfrey**[1], **David Burn**[1], **Lynn Rochester**[1]
[1]Newcastle University

## K - Balance support device; Falls and falls prevention

**P4-K-146 Electromyography (EMG) Analysis of Trunk and Leg Muscles Activities during Whole Body Tilt of 3D Dynamic Exercise Device**

***Chang-Ho Yu***[1], **Sun Hye Shin**[1], **Mi Yu**[1], **Kyung Kim**[1], **Ho Choon Jeong**[1], **Tae-Kyu Kwon**[1]
[1]Chonbuk National University

**P4-K-148 Sitting Balance in Individuals with Spinal Cord Injury and the Effects of Application of Functional Electrical Stimulation for Improving Sitting**

***Matija Milosevic***[1], **Kei Masani**[2], **Meredith Kuipers**[1], **Noel Wu**[1], **Molly Verrier**[2], **Kristiina Valter McConville**[3], **Milos Popovic**[1]
[1]University of Toronto, [2]Toronto Rehabilitation Institute-UHN, [3]Ryerson University

**P4-K-150 Effect of Brainport balance device training on posture and gait in elderly patients with unilateral vertibular loss**

***Toshiaki Yamanaka***[1], **Yachiyo Sawai**[1], **Takayuki Murai**[1], **Taeko Ito**[1], **Naoki Shimizu**[1], **Hideyuki Okamoto**[1], **Nobuya Fujita**[2], **Hiroshi Hosoi**[1]
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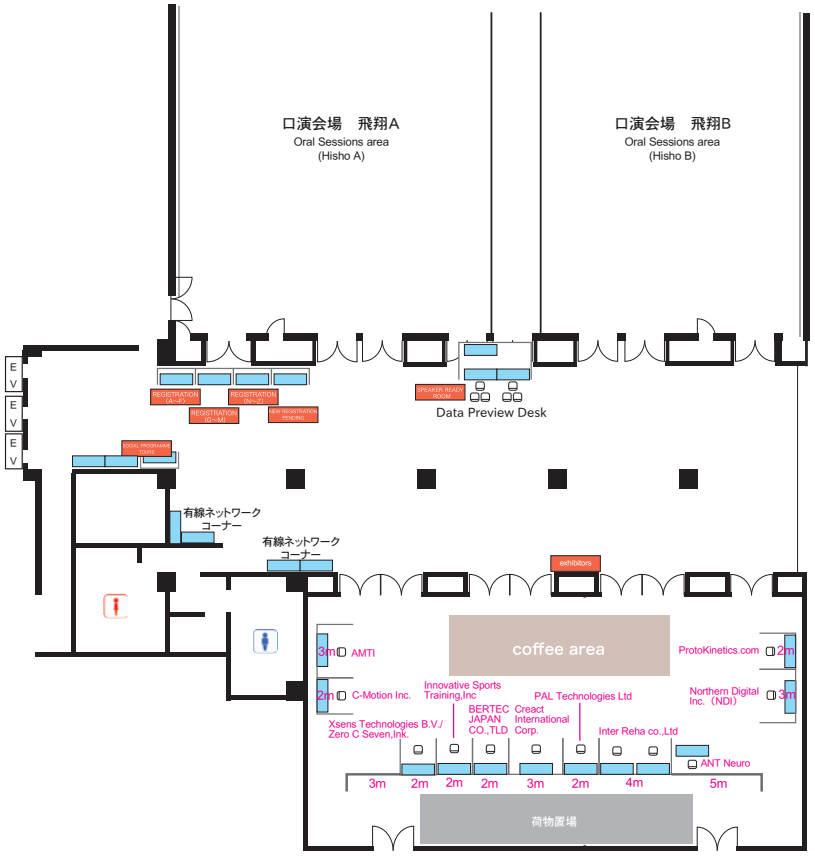


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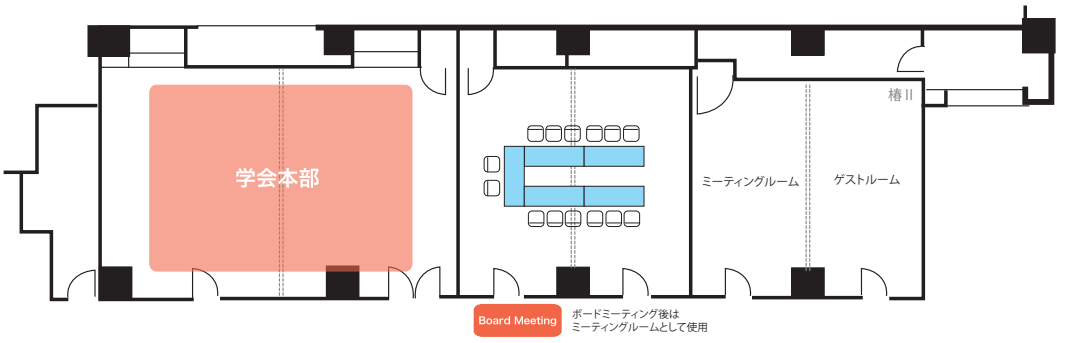
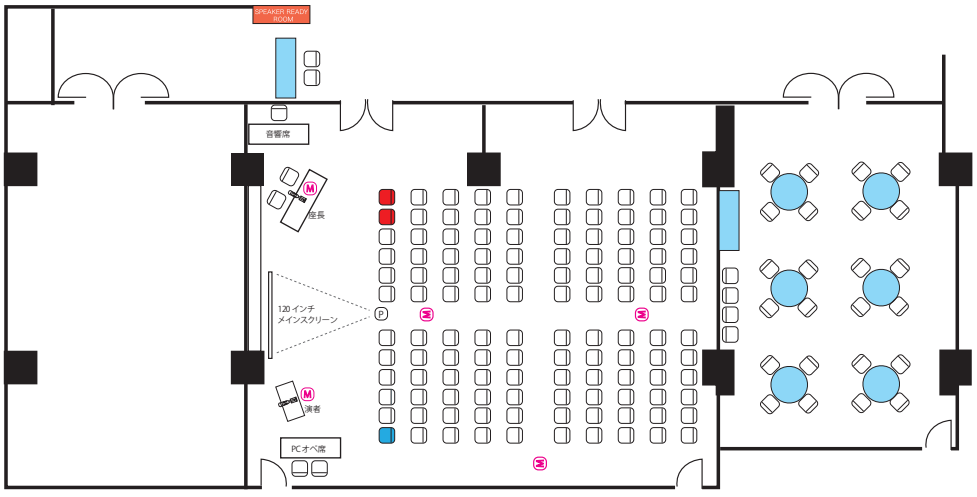
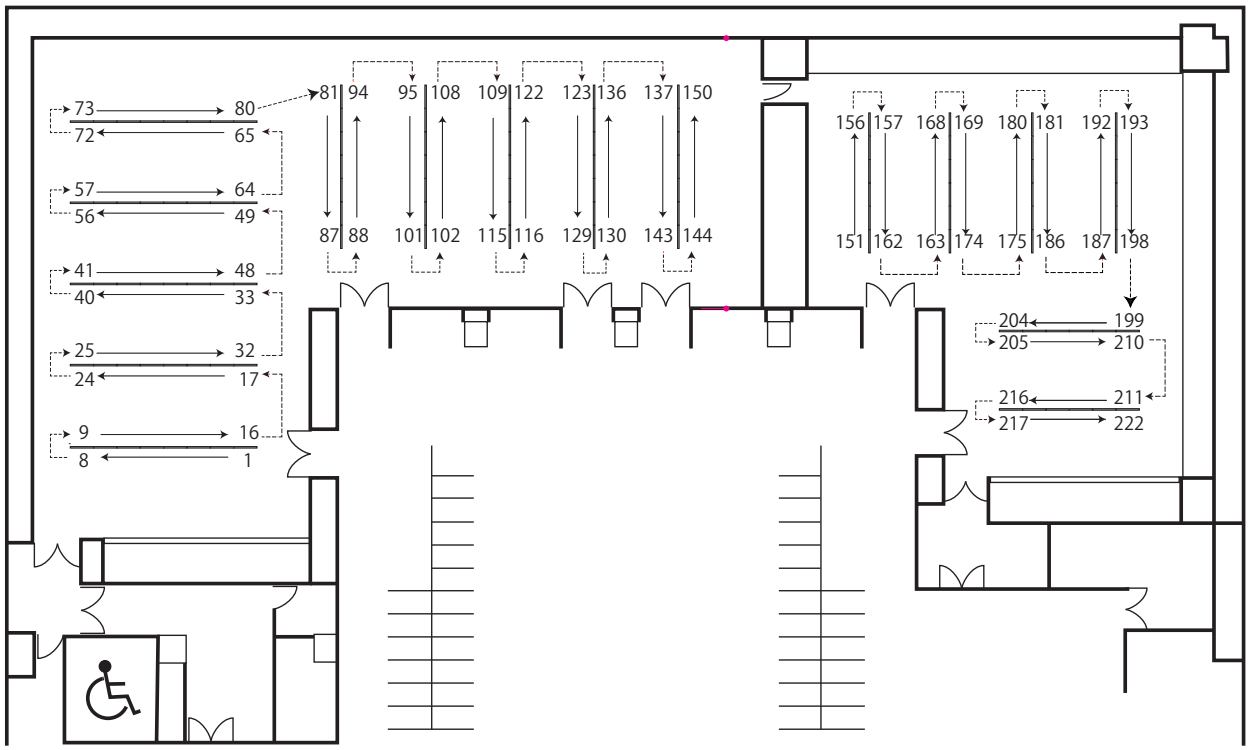


# Poster Floor Plans

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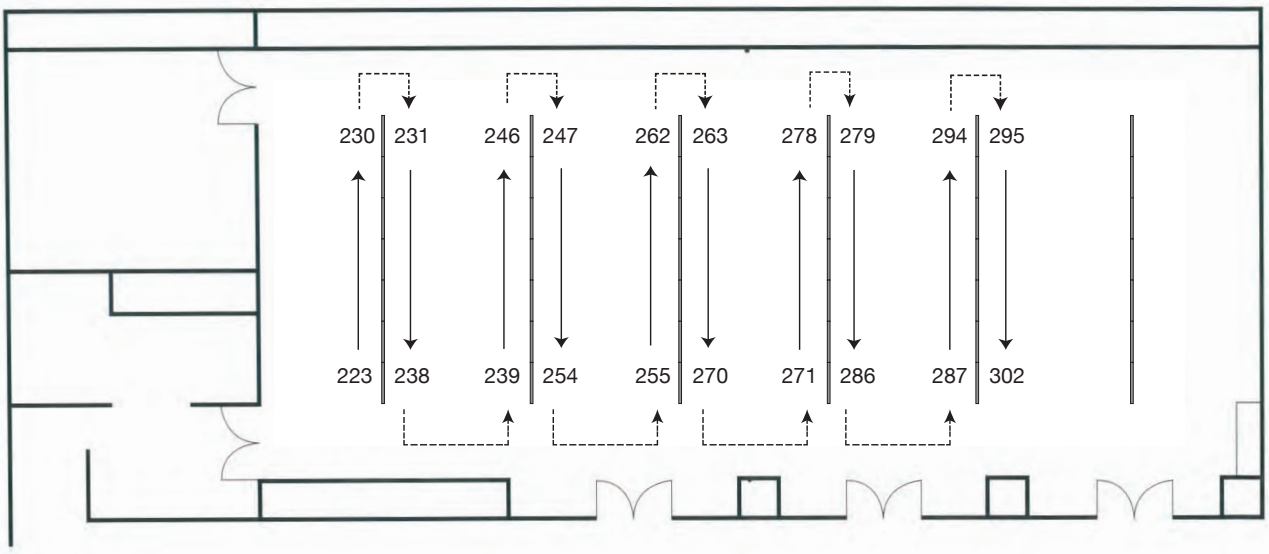


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