



LA PRÉVENTION AU CŒUR D'UNE MEILLEURE SANTÉ  
BETTER HEALTH THROUGH PREVENTION

# 2<sup>nd</sup> Annual **PERFORM** Centre Research Conference

**LIFESTYLE INFLUENCES ON HEALTH:  
NUTRITION, SLEEP AND ACTIVITY**

## **ABSTRACTS**

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*Please note abstracts are subject to change*



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# I. ACTIVITY

Poster #1

## **Revisiting the Sport Personology Debate: A Canonical Variate Analysis of Personal Traits and Physical Activity Interests**

James Gavin, Matthew Keough, Madeleine Mcbrearty, Michael Abravanel, and Tatiana Moudrakovski  
**Concordia University**

### **Abstract**

Two studies employing canonical variate analysis (CVA) generated evidence on the relationship between personality and physical activity interests and involvement. In the first study involving 1,885 community-based participants, 8 canonical functions were created with statistical tests revealing that the canonical correlations differed significantly from zero. Our interpretations of the first three canonical functions, which together explained 94% of the overlap between traits and interests, indicated that higher trait scores on competitiveness, thrill-seeking, and assertiveness corresponded to stronger interests in martial arts, outdoor activities, and competitive sports, that higher thrill seeking and spontaneity scores were associated with greater interests in martial arts and outdoor activities, and that elevated self-reliance and mental focus but reduced spontaneity were aligned with stronger interests in weight training but reduced interest in class training. The second study involving a smaller (N=286) university-based sample had the advantage of self-report measures of activity participation. Statistical tests revealed that the set of 7 canonical correlations between traits and interests differed significantly from zero. Interpretations of the first four canonical functions showed some similarities with the first study's results. The CVA pertaining to traits and participation also resulted in canonical correlations that differed significantly from zero. Though interpretations of the first four canonical functions seemed meaningful, the patterns of association were dissimilar from those involving traits and interests. In conjunction, these studies argue for continued employment of this methodology in investigations of sport personology with an eye to creating practical methods to assist individuals in making rewarding and sustainable PA choices.

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## **PSYCHOSOCIAL FACTORS AFFECTING ADOLESCENTS' SUSTAINED ENGAGEMENT IN PHYSICAL ACTIVITY**

James Gavin, Madeleine Mcbrearty, Kit Malo, Michael Abravanel, Tatiana Moudrakovski  
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### ***Abstract***

The purpose of this study was to explore adolescents' perceptions of psychosocial influences - personal characteristics, environmental factors and behavioural undertakings - influencing their prolonged involvement in sports and physical activity (PA). A qualitative approach was adopted wherein 16 adolescents (8 boys, 8 girls; mean age 15.9 years), who had been physically active for at least the last 8 years, and sixteen adults identified as their 'parents' or 'guardians' participated in semi-structured interviews. Interviews were transcribed verbatim and coded using the HyperRESEARCH software. Data were analysed using thematic analysis procedures. Four main themes pertaining to psychosocial influences were identified: 1) personal characteristics; 2) school and community resources; 3) parental support; and 4) social interaction. Except for social interaction, for which participants did not identify challenges, themes are discussed according to their motivational aspects and the challenges they represent for adolescents' PA involvement. Interpreted in a framework of reciprocal determinism, our data would suggest that personal characteristics of those who remain physically active are: 1) passion for the activity in which they are involved; 2) positive self-concept shaped by prolonged involvement with the activity; 3) intrinsic as well as extrinsic motivation; and, 4) high self-efficacy beliefs translated into a continuous desire for improvement, striving to reach increasingly more difficult goals and engaging in competitive relations with self and others. The research has implications for health promotion endeavours directed toward parents of children and adolescents. Given the limitations of a qualitative study, readers are invited to apply the conclusions to their own context.

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### Healthy Bodies, Healthy Minds -Within and Between-Person Effects of Physical Activity on Cognition

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**Background:** Although there is no cure for dementia, a growing body of research supporting the benefits of physical activity (PA) on cognition continues to accumulate. Yet, a firm understanding of the individual differences and between-person effects of PA on cognition in older adults is lacking. The study aim was to better understand the between- and within-person effects of PA and other health behaviours on cognition of older adults. **Methods:** Participants were encouraged to walk at least 3 times per week at a brisk intensity for 16 weeks. Cognition, and PAAwalking measures were completed at 0, 6, 9, 12, and 16 weeks. **Results:** 118 participants (91 females, 27 males, mean age = 72.81±5.24 years) were included in the analysis. Moderate to vigorous walking and PA and measures of cognition improved significantly with each additional week in the walking program and improvements in walking/ PA and measures of executive functioning and working memory occurred at a significantly decreasing rate over time ( $r = .213$  to  $.660$ ,  $p < .001$  for walking/PA and  $r = -.04$  to  $.304$ ,  $p < .001$  for cognition). Time-varying covariation models revealed significant: 1) within-person effects of walking and PA on measures of executive functioning and 2) consistent between-group effects of cognitive activity, but not other lifestyle behaviours, on cognition. **Conclusion:** Distinct patterns of within- and between-person effects on the PA and cognition were observed. Further work will need to continue to clearly elucidate the within- and between-person sources of variation in relations between PA and other health behaviour and cognition using well-designed longitudinal and experimental designs.

Presenting Author: Kristina Kowalski

**Targeted LC-MS metabolomics approach for absolute quantitation of neuro-regulatory metabolites in peripheral fluids for an assessment of endocrine homeostasis in humans**

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Neuro-endocrine homeostasis in healthy individuals could be affected by slight perturbations in CNS (central nervous system)-to-periphery and feedback regulatory networks which may cause severe pathological conditions and illness if persistent. The early detection of such perturbations ensures on-time application of preventive measures but requires simultaneous measurements of multiple analytes at high sensitivity. Immunological assays can usually satisfy these requirements but have high per-target-price and in many cases show compromised specificity toward low molecular weight metabolites. To bypass these limitations, analytical mass spectrometry metabolomic analysis for absolute quantitation of multiple neuroendocrine mediators in human biofluids with high selectivity and lower cost than immune assays is currently being developed in our laboratory.

Our method focuses on 26 key regulatory target metabolites which include hypothalamic-pituitary-adrenal (HPA) and hypothalamic-pituitary-thyroid (HPT) members such as thyrotropin-releasing hormone (TRH), thyroid-stimulating hormone (TSH), corticotropin-releasing hormone (CRH), adrenocorticotrophic hormone (ACTH), inter-axis regulators (beta-endorphin, serotonin, dopamine, melatonin) and multiple representatives of peripheral subordinated and feedback pathways, such as kynurenine and cortisol. The analysis is performed using multiple reaction monitoring (MRM) protocols on triple quadrupole mass spectrometer coupled to ultrahigh pressure liquid chromatograph (UPLC) equipped with reversed-phase column packed with C-18 stationary phase. Sample extraction is performed using conventional solvent and solid phase precipitation methods optimized for the target list of analytes and several improved methods for metabolome extraction from plasma were examined to increase sensitivity of our assay to low pg/mL levels.

To the best of our knowledge, this is the first MRM assay which has been developed for the quantitation of ACTH and beta-endorphin hormones. Preliminary analytical validation data demonstrates good method reproducibility and accuracy as recommended by FDA at medium pg/mL (low nM) concentrations for several targets including cortisol and cortisone, and full method validation of all targets is currently ongoing.

The novelty of our work is in development of MRM protocols for new neuroendocrine targets. In addition, metabolites which are targeted in our study respond to a large number of stimuli such as exercise (cortisol, T3, T4), sleep (TSH, melatonin, cortisol, ACTH, catecholamines) and stress (cortisol, ACTH, catecholamines). Therefore, this targeted metabolomic assay has high diagnostic flexibility and can be applied for both preventive and clinical studies.

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**Exercise and orthotic therapy to improve foot functions and gait performance for the patient with plantar fasciitis.**

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**Introduction:** Plantar fasciitis is one of the most common foot disorders in the adult population with 10 %. The mainstay of treatment for plantar fasciitis is a conservative treatment. Exercise and orthosis are used the most common clinically to reduce tissue stress, to restore muscle strength and flexibility of tissue involved. The purpose of this study was to estimate the extent to which exercise and orthosis improves foot function of the patient with plantar fasciitis .

**Materials and methods:** 22 patients were enrolled in the trial. Patients were instructed to receive orthotic supports and do exercises. The exercise was performed three weeks and the orthotic supports was used for three months. Foot function was evaluated by AOFAS–mid foot and AOFAS – hind foot; walking velocity and cadence were measured by 12 minute walking test. These values were measured at baseline, third week and 12th week after the therapy.

**Results:** There was a significant improvement in both hind- foot and mid- foot function after treatment ( $p<0.05$ ) and this improvement also was maintained for three months ( $p<0.05$ ). In terms of cadence and walking speed, there was no significant difference after three weeks and three months ( $p>0.05$ ).

**Conclusion:** Exercise in combination with orthosis is an effective treatment in terms of foot function.

**Key words:** Plantar fasciitis, exercise, orthosis.

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**The impact of feeling close to a future body image on women's health behaviour intentions**

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**Abstract**

Research has focused on how feeling close to a possible body image affects women's motivation to engage in weight-loss dieting behaviours but few studies have investigated the impact on general health behaviours. Past research has found that at-risk individuals who were shown their present body image had stronger intentions to engage in physical activity. It is unknown whether considering a negative future body image may also serve to motivate health behavior change.

This online study investigated how feeling subjectively close to a future body image influenced women's health behaviour intentions. 105 women aged 18 to 65 were randomized to select their most desired or most undesired body shape from a range of silhouettes and then to vividly imagine or simply think about having this body shape one year in the future. Participants then completed a measure of health behaviour intentions. A hierarchical multiple regression found a significant main effect for experimental condition on health behaviour intentions,  $F(3, 95) = 2.035$ ,  $p < .05$ ,  $R^2 = 0.797$  (controlling for general health behaviors). Women reported stronger health behaviour intentions when asked to vividly imagine rather than simply think about having their most undesired body shape ( $P = 0.095$ ,  $P < .05$ ) one year in the future. These findings suggest that avoidance motivation, a type of motivation underlying dieting behaviours, may also contribute to women's motivation to engage in healthy behaviours: women who felt close to their undesired body shape had stronger motivation to engage in health behaviours.

**Keywords:** body image, health behaviours.

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**FREQUENCY-SPECIFIC 10 Hz ELECTRICAL STIMULATION CAUSES LONGER REACTION TIMES IN A TONE DISCRIMINATION TASK USED IN A POSTURAL DUAL-TASK PARADIGM**

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**Introduction:** Reaction times are improved when neural oscillations are enhanced in the alpha (8-12Hz) or gamma (30-80Hz) ranges. Oscillations can be entrained via electrical stimulation. Reaction time tasks used in conjunction with postural tasks can identify how posture monopolizes attention. Alpha and gamma range afferent electrical stimulation could influence neural oscillators and a posture/ tone discrimination dual task. **Methods:** Transcutaneous Electrical Nerve Stimulation (TENS) was given to the median nerve, in 5 conditions: no stimulation, 10Hz, sham 10Hz, 55Hz and sham 55Hz, to 8 subjects (4F, 4M, 18-30 years of age, healthy). Choice reaction time and correctness in finger movements were measured in a tone discrimination task during a postural dual-task paradigm. Reaction times, correctness, COP excursion and range were compared across TENS conditions, in dual- and single-task. COP data (Neurocom) were collected under eyes open, eyes closed and eyes closed with sway referenced support conditions. **Results:** There were no significant differences in correctness across conditions. There was a TENS frequency effect on reaction time; reaction times were longer when 10Hz TENS was given. There was a main effect of postural condition; the eyes closed, sway referenced condition had larger excursion and range. There was an interaction of TENS frequency by postural condition for excursion. Post-hoc differences were more evident when comparing the 10Hz and sham 55Hz than other TENS frequencies. **Conclusion:** 10Hz TENS lengthened reaction times and may have an effect on postural dual-task performance. Rhythmic afferent stimulation could be a way to explore timing mechanisms in dual-task performance.

**Impact of a three-month physical exercise program on executive functions and mobility in frail and non-frail older adults.**

Ramzi Houdeib <sup>1,2,3</sup> David Predovan <sup>3,4</sup>, Francis Langlois <sup>5</sup>, & Louis Bherer <sup>1,2,3</sup>

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**Abstract**

Growing evidence supports the use of physical training interventions to improve both physical and cognitive performance in healthy older adults. Few studies have examined the impact of physical training on cognitive outcomes in physically frail older adults. In the present study 38 non-frail participants ( $M_{\text{age}} = 69.84$ ,  $SD = 5.48$  years) and 34 frail participants ( $M_{\text{age}} = 74.94$ ,  $SD = 5.96$  years) were assigned to a three-month physical training group or to a control group (waiting list). Physical training sessions were conducted three times per week for 60 minutes and involved primarily aerobic activity. All participants completed pre- and post-test measures of cognitive performance (Stroop task) and mobility measures (comfortable and maximum walking speed and 6 minutes walking test). After three months, the trained non-frail group showed significant improvement on the inhibition condition of the Stroop. Furthermore, the trained frail group showed significant improvement on the flexibility condition of the Stroop and on the 6 Minutes walking test. Interestingly, in the trained non-frail group a correlation was found between improvements in the inhibition condition of the Stroop task and the maximum walking speed. This current study supports previous findings that suggest a relation between cognition (executive control) and gait in an elderly population. Taken together, the results suggest that even short-term physical interventions can enhance older adults' executive functions and mobility.

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## Fair play? Inequity in opportunities for active play across elementary schools

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**Key Words:** Active play; Schools; BMI; Child adiposity; Built environment.

**Introduction:** Little research has attempted to systematically describe how elementary schools differ on the basis of the availability of equipment that can be used for active play. The purpose of the present study is to describe school typologies based on variation in their availability of indoor and outdoor play equipment. We also attempt to assess whether differences in school play environments are prospectively associated with child adiposity.

**Methods:** We studied 513 children attending 296 schools followed longitudinally in the context of the Quebec Adipose and Lifestyle Investigation in Youth study. The characteristics of school play environments were obtained at the baseline collection when students were between the ages of 8 and 10. A trained nurse directly assessed child anthropometric measurements two years later.

**Results:** We used k-clusters analyses to identify school typologies that differed in terms of: (1) The indoor play environment and (2) the outdoor play environment. Our analyses allowed us to describe 4 distinct school typologies that differed in the quality of their play environments. Generalized estimation equations indicated that quality of students play environment was related to adiposity indicators 2 years later.

**Conclusions:** Students attending schools with more indoor play equipment such as trampolines, climbing walls, and devil sticks, were likely to be leaner two years later. Research has challenged the notion that children are naturally inclined to engage in physically active play. Our results suggest that when play opportunities are fun, children may spend more time engaged in physical activities.

## Organization of Functional Hubs in Healthy Human Brain

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### Abstract

Brain hubs are the brain regions with high centrality in a network system and assumed to promote global communications between functionally specialized networks. They allow the hierarchical processing of information, thus damage to hubs can have a more diffuse, crucial effect on the system than does damage to non-hub regions. We developed a method to detect hubs and network structure within the hubs reliably in the resting-state fMRI. It decomposes the whole brain signals into resting-state networks (RSNs) building a global dictionary, and a time-course in each voxel is represented by a sparse linear combination of temporal dynamics selected from the dictionary. Multi-level analysis based on bootstrap resampling and spatial clustering improves accuracy and reliability, allowing the detection of hubs by counting the number of overlapped RSNs. We analyzed public dataset in 1000 Human Connectome Project that provides resting-state fMRIs from 25 healthy subjects (10M/15F, age:  $29.44 \pm 8.84$ ). In each subject, 20 RSNs were defined to obtain a hub map, which is further standardized to identify group-level hubs by averaging. Hubs are concentrated in heteromodal association cortices; including parts of precuneus, posterior cingulate, frontal, superior and inferior parietal, and superior and medial temporal cortices, and parts of angular, supramarginal, and fusiform gyri. The results are consistent with hubs reported in recent studies based on correlation-based degree analysis in graph theory. Furthermore, it offers a more realistic model of brain network by providing information on distinguishable patterns of network overlap within the hubs as a potential biomarker of neurological disorders.

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## Comparison of the Spatial Resolution and Crosstalk of Inverse Operators in EEG and MEG

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### Introduction:

The spatial resolution of an EEG or MEG inverse operator is an important feature for distributed source localization when estimating spatial extent of the underlying generator, or when assessing how functional connectivity patterns could be biased by crosstalk between sources.

### Method:

We estimated the resolution matrix (*Grave de Peralta Menendez et al, Human Brain Mapping, 1997*) to evaluate the spatial resolution properties of 4 source localization methods, namely: the minimum norm estimate (MNE) and its noise-normalized extensions (dSPM and sLORETA) as well as the maximum of entropy on the mean (MEM, *Chowdhury et al, Plos One 2013*) when applied either on high-density EEG (256 electrodes) or MEG data (275 gradiometers). While the resolution matrix of MNE, dSPM and sLORETA was calculated analytically, the resolution matrix of MEM was constructed using Monte-Carlo simulations, since MEM is not a linear operator. We characterized the resolution matrix of each method using measurements of dipole localization error and spatial dispersion, when applied whether on point spread functions (PSF) or crosstalk functions (CTF) (*ie* rows versus columns of the resolution matrix). The data were then validated with 5 subjects using somatosensory data.

### Results:

Our results showed that the localization error was similar for all the techniques for PSF and CTF, except for sLORETA providing zero-error for PSF as expected in absence of noise. Besides, MEM showed more accurate results in terms of spatial dispersion in PSF and CTF, when applied either on EEG or MEG data.

### Conclusion:

The study shows that MEM has higher spatial resolution than linear techniques.

### **Individual Differences in Proactive and Reactive Control Processes in Bilinguals**

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Bilingualism is one of many examples of brain plasticity and evidence suggests that bilinguals exhibit superior cognitive control compared to monolinguals by using a flexible combination of proactive processes (monitoring for relevant cues) and reactive processes (inhibiting irrelevant information) to cope with interference from the nontarget language (Morales et al., 2014). This flexibility may be related to individual differences in language-switching behaviours, bilingual proficiency, age of acquisition of the second language (L2), or general executive functioning.

We used event-related brain potentials to examine proactive and reactive control processes in young adult bilinguals (English-French or French-English; mean age = 24; mean self-rated proficiency: L1 = 4.84/5; L2 = 3.8/5). Participants were presented with the following cue-target letter pairs: A-X, A-Y, B-X, or B-Y (B and Y are any letter other than A or X). The task was to press the “yes” key when presented with A-X pairs and the “no” key for any other combination. We varied the global context of each block (e.g., 70% A-X vs. 70% A-Y). We hypothesized that participants will be prone to incorrectly respond “yes” to A-Y pairs in the A-X-70% block and to incorrectly respond “no” to A-X pairs in the A-Y-70% block. Cue-locked ERPs should reflect proactive processes and response-locked ERPs should reflect reactive processes. We will report the extent to which behavioural and ERP effects are modulated by individual differences in language switching behaviours, proficiency, age of acquisition of L2, and general executive functioning.

**The Impact of Cognitive Training on Brain Electrophysiology and Divided Attention in Healthy Older Adults.**

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**Abstract**

One of the abilities most affected by age-related cognitive decline is divided attention, which may hinder the quality of life of older adults. Previous research has shown that cognitive training techniques are promising in improving divided attention, yet the findings have been mixed due to a failure to identify mechanisms by which cognitive training works in the brain. Investigating the effects of cognitive training on electrophysiological brain activity might elucidate the mechanisms underlying positive effects and allow selection of better training methods.

We examined how differences in electroencephalograph (EEG) brain activity correspond to behavioral performance in healthy older adults. Participants (mean age 69.5 years, SD=6.42) were tested on a divided attention task (a visual detection and a working memory arithmetic task), after which they underwent 2 weeks of cognitive training. Participants were randomly assigned to three training groups: The single task training group (STT, N=14) practiced each of the two tasks separately; the fixed attention training group (FAT, N=13) was trained to assign equal attention to both tasks concurrently; while the variable attention training group (VAT, N=14) was trained to assign variable amounts of attention while performing the tasks concurrently. EEG measures were taken pre- and post-training. Preliminary findings indicate training-dependent differences in performance on the divided attention task that correspond to differences in early attention-related ERPs post-training. Furthermore, functional connectivity in fronto-parietal regions will be investigated through EEG coherence. Results indicate that the type of training is critical in changing the pattern of brain activation.

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**Bilingual Speech Perception in Noise; An Electrophysiological Investigation of  
Semantic Context Use in the Native and Non-Native Language**

Alexandra Covey, Dr. Natalie Philips & Alexandre Chauvin

**Abstract**

Bilingual listeners are better able to perceive speech-in-noise in their native language compared to their non-native language. Processing in one's second language is less automatic (Segalowitz, 2010) and requires significantly more cognitive resources than processing in one's first language (McLaughlin et al., 1983). The current study investigated the relation between the bottom-up signal of degraded speech and top-down mechanism of semantic integration in bilinguals. Event-related brain potentials (ERPs) were recorded in a pilot sample of French-English highly proficient bilingual individuals. Participants identified the final target words in 240 Speech-Perception-in-Noise (SPIN) sentences presented in a total of 8 conditions. The sentences were presented in combinations of language (native vs non-native), noise (+1dB vs quiet) and context (high vs low predictability). The ERP component of interest to this study is the N400 because it is the most reliable ERP component related to semantic processing of language (Kutas & Hillyard, 1980). This component allows to study strength and timing of language processing. We predicted that bilinguals processing speech in noise in their second language (L2) would not use contextual cues as efficiently as in their first language (L1); thus we expected to see a smaller N400 effect in L2 compared to L1. Preliminary results show that presenting contextual cues yielded an overall facilitation of processing sentences in degraded speech. There was no significant difference in performance when contextual cues were provided between L1 and L2. Furthermore, participants showed a large N400 effect in L2. These preliminary findings suggest that these bilingual individuals were able to make use of contextual cues to compensate for degraded speech in their non-native language. It should be noted that participants were extremely proficient in their L2 suggesting that linguistic background needs to be taken into consideration when studying bilinguals' use of contextual cues in acoustically degraded conditions.

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**Diffuse optical tomography using optimal optode montage**

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Introduction: Diffuse Optical Tomography (DOT), allows the investigation of hemodynamic brain responses associated with neuronal activation. We recently presented a method for computing an optimal optode montage that maximizes the spatial sensitivity on specific brain regions. We hypothesize that the optimal montages are well adapted for DOT. Methods: We simulated realistic absorption changes ( $\Delta \mu_a$ ) signals in spherical Volumes Of Interest (VOI) in the gray matter of an anatomical head model. We also simulated realistic physiological noise in order to generate realistic optical density changes on the scalp. For each VOI, two arrangements were evaluated. The first arrangement was an optimal montage (8 sources and 16 detectors), the second was a regular montage. We evaluated the spatial and quantitative accuracy of tomographic reconstructions for the two arrangements. Results: 1) We found that the proportion of reconstructed voxels in each VOI (spatial sensitivity) was larger for the optimal arrangements. In addition, the deviance index, which measures the dispersion of the reconstructed activity outside the VOI, was smaller for the optimal montages. 2) Quantitatively, the difference between the mean amplitude of the simulated and reconstructed  $\Delta \mu_a$  signal was smaller for the optimal montages. Conclusions: We found that the tomographic maps of optimal SD montages had better spatial properties than regular arrangements. With optimal montages, most of the activity was captured in the original VOIs and the remaining activity was reconstructed in their vicinities. In addition, we observed that optimal montages yielded better quantitative accuracy and were less sensitive to the physiological noise

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## Cognitive Compensation in the Context of an Unpredictable Platform Perturbation

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### Abstract

**Introduction:** Epidemiological research indicates a link between hearing loss and mobility. A potential explanation is that cognitive compensation occurs in both auditory and postural tasks in older adults. **Methods:** We investigated this hypothesis using a dual-task paradigm. Healthy young adults (YA; n = 29), older adults (OA; n = 25) and older adults with hearing loss (OAH; n = 10) completed cognitive (modified n-back) and balance (balancing on a moving platform) tasks singly and concurrently under noisy and quiet conditions with background noise (babble) used to simulate auditory aging. **Results:** Importantly, an interaction between task difficulty, listening condition and group indicated that OA and OAH made more cognitive errors in the dual-task noisy condition than YA. The kinematic data indicated a main effect of task challenge and group whereby the total amount of postural sway increased in dual-task conditions and was greater for both YA and OA than OAH. **Conclusion:** Together, the results suggest that dual-tasking has a negative effect on auditory-cognitive performance and that OAH exhibit a postural prioritization response as a means of protecting balance.

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**Age-related hearing loss and gait adaptations: Early evidence for postural prioritization in the elderly**

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**Abstract**

**Introduction:** Age-normative hearing loss is linked with reduced cognitive functioning, mobility decline, and increased falls risk in older adults. This study examined age-related differences in allocation of cognitive resources between concurrent walking and listening tasks. Seventeen younger and twelve older adults with normal hearing participated. **Method:** Three sentences (1 target, 2 maskers) were played simultaneously from different locations (left, center, right) in a virtual reality street crossing scene. Target location probability (100% versus <75%) was varied. Participants reported the number and colour in the target sentences. Gait during self-paced treadmill walking was assessed with motion capture system using active markers positioned on the head, sternum, sacrum, and feet. There were 3 conditions: walking, listening, and walking while listening. Key dependent measures were listening accuracy, head and trunk position, and stride time variability. **Results:** Word recognition accuracy was significantly worse in (a) older than younger adults, (b) dual- than single-task, and (c) less predictable location probability. Kinematic analyses revealed that older adults decreased their head pitch and stride time variability when moving from single-task walking to dual-task conditions, while younger adults showed a reverse pattern. **Conclusion:** Listening performance in old age is particularly hampered when concurrently walking and when the signal location becomes less predictable. Furthermore, older adults' gait variability worsened when simultaneously listening. The findings suggest that listening challenges affect mobility and provide early evidence to explain the link between age-related hearing loss and gait adaptations.

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## **Understanding age-related differences in Backward Inhibition through Proactive and Reactive control processes**

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### *Abstract*

Backward Inhibition (BI) refers to suppression of recently executed task sets, while switching to new tasks. Empirically, BI reflects a reaction time cost when returning to a recently abandoned task (A in ABA) compared to returning to a task not recently performed (A in CBA). The BI effect is assumed to be a result of proactive control process, facilitated by valid task cues, and is hypothesized to decline with age. However, previous research has shown age equivalent BI effects when task sets are cued (Mayr, 2001) or to-be-remembered sequences (Li & Dupuis, 2008). In a two experiment study, we examined whether i) BI can also be triggered by reactive control process, ii) if yes, does the size of the age difference in BI depend on the control demands of the task? In the first experiment, to elicit both proactive and reactive control, we used a cued Word Recognition task, where participants made key press responses (Yes or No) to words from three categories based on cues. List words were intermixed, appearing singly or with flankers. To measure proactive inhibition, the RTs on the A of ABA sequences were compared against the RTs of the A in CBA sequences. To measure reactive-set inhibition and the RTs on N-1 flanker trials were compared against the N-2 flanker trials. In the second experiment, the task was modified (no cues) to elicit varying degrees of reactive control. The results from both the experiments suggest that BI can be initiated both by proactive as well as reactive control processes. Further, older adults showed reduced BI effects as the reactive control demands of the task increased, suggesting that age-related declines in inhibitory processes are tied to the control demands of the task.

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## **Quantitative magnetic resonance imaging analysis of the cervical spine extensor muscles: A Pilot Study**

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### **ABSTRACT**

#### **Introduction:**

Variations in cervical muscle cross-sectional area (CSA) and composition, particularly of the multifidus muscle, have been reported in patients with chronic neck pain. However, few studies have reported on the reliability of such muscle measurements and there remain no standard protocol for tissue segmentation. Therefore, the purpose of this pilot study was to provide a detailed muscle measurement protocol and determine the reliability of associated cervical muscle size and composition measurements using an open-source image analysis software (ImageJ).

#### **Methods:**

Cervical magnetic resonance images of 10 individuals with spinal stenosis were selected from an internal database. Muscle CSA and functional cross-sectional area (FCSA, fat-free area) measurements of the multifidus, semispinalis cervicis, semispinalis capitis and splenius capitis were acquired bilaterally from axial T2-weighted magnetic resonance image from C2- C3 to C6-C7 levels. All measurements were repeated twice, at least 5 days apart and the assessor was blinded to all earlier measurements.

#### **Results:**

The reliability for the upper (C2-C3, C3-C4) and lower cervical levels (C4-C5, C5-C6, C6- C7) was assessed separately. The intrarater reliability measurements were comparable between muscles and spinal levels. The intra-class correlation coefficients (ICC) for the CSA measurements varied between 0.90-0.99 at C2-C4 and 0.87-0.98 at C4-C7. The reliability was similar for the FCSA measurements and varied between 0.78-0.93 at C2-C4 and 0.78-0.93 at C4-C7.

#### **Conclusion:**

The results of this pilot study suggest that the proposed method to investigate cervical muscle size and composition is reliable, with excellent reliability across cervical muscles and vertebral levels.

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**Effects of a stationary bicycle training regimen in people with Parkinson's disease**

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**Introduction:** In Parkinson's disease (PD), the dopaminergic system dysfunction is often accompanied by a decrease in motor learning capacity, executive function impairments and alteration of gait patterns. Different types of physical activity have been shown to effectively improve these parameters in PD individuals. Yet, no study examined the effect of a stationary bicycle training regimen designed to improve aerobic capacity on these measures. **Objective:** To assess the improvements of such an exercise program on motor learning capacity, executive functions and gait parameters in people with PD and age-matched healthy control, as well as to account for the moderating role of the disease in this process. **Methods:** Nineteen PD patients (Hoehn & Yahr <2) and 20 healthy adults, matched on age and sedentary level, were recruited and evaluated for their aerobic capacity, gait pattern, executive functions and motor learning before and after a 3-month bicycle training regimen (3x 1h/sem.). **Results:** Aerobic capacity, inhibition and sequential motor learning improved significantly in both groups after the 3-month exercise regimen, but only the PD patients improved significantly their walking speed. Only in PD patients, the training-related increases in aerobic capacity and sequential motor learning capacity correlated positively with the improvement in walking speed. **Conclusion:** Our results suggest that several motor and functional parameters are improved through a 3-month stationary bicycle training regimen, both in PD patients and healthy adults. Improvement in various domains was particularly found in PD individuals, suggesting that physical exercise does have a greater impact in this population.

**The impact of skeletal muscle aging on mitochondrial morphology: a quantitative transmission electron microscopy study.**

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**Abstract**

**Background:** Skeletal muscle aging is associated with a progressive decline in muscle mass and strength, a process named sarcopenia. Strong evidence points towards a causal role played by accumulation of mitochondrial dysfunctions in the development of sarcopenia, a process that could be triggered by impaired mitophagy. It is now recognized that mitochondrial function, mitophagy and mitochondrial morphology are interconnected. However, the impact of muscle aging on mitochondrial morphology remains unknown.

**Methods:** To address this issue, we assessed the morphology of SubSarcolemmal (SSm) and InterMyoFibrillar (IMFm) mitochondria in skeletal muscle of young and old mice using a quantitative transmission electron microscopy approach.

**Results and Conclusions:** We show that aging-related muscle atrophy is associated with larger and less circular SSm, and more complex (increased length and branching) IMFm. In line with these morphological changes, and although no difference in the content of proteins regulating mitochondrial dynamics (Mfn1, Mfn2, Opa1 and Drp1) was observed, a mitochondrial fusion index (Mfn2-to-Drp1 ratio) was significantly increased in aged muscles. Our results reveal that muscle aging is associated with complex changes in mitochondrial morphology that could interfere with mitochondrial function and mitophagy, and thus contribute to aging-related accumulation of mitochondrial dysfunction and sarcopenia.

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**White Matter Correlates of Motor Sequence Learning  
and Consolidation in Young and Older Adults**

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**INTRO:** Older adults fail to demonstrate spontaneous performance gains in motor sequence learning (MSL) tasks, usually seen in young adults following a retention interval that includes sleep (consolidation). To date, few studies have investigated age differences in white matter substrates of MSL, and none have addressed the issue of sleep-dependent consolidation.

**METHODS:** Groups of 28 young (20-35 years old) and 29 older subjects (55-70 years old) were trained on an explicit MSL task (5-item sequence, 12 sequences/block, 14 blocks/session). Participants were randomly assigned to either a “nap” or “awake rest” condition for the 90- minutes retention interval between test and retest sessions. Offline gains in performance (i.e. reflecting MSL consolidation) were computed by comparing the last four blocks of the training session with the first four blocks of the retest session. A structural T1\*-weighted and a high angular resolution diffusion MRI were acquired. Whole-brain analyses relating interindividual variability in fractional anisotropy (FA) and other measures of diffusivity to offline gains were carried out using TBSS (Tract-Based Spatial Statistics).

**RESULTS :** FA in a frontal area of corona radiata, corpus callosum and superior longitudinal fasciculus crossing fibers correlated negatively with consolidation scores in younger adults. Furthermore, these gains correlated positively with the Number of Fiber Orientations within this region. No significant associations between performance gains and diffusivity measures were observed in older adults.

**CONCLUSION :** This study provides the first evidence that age-related white matter differences in tract configuration could contribute to the motor memory consolidation deficit seen in elderly adults.

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**Investigation of the impacts of aging and physical activity levels on skeletal muscle phenotype in men**

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**Abstract**

**Background:** Aging is associated with a progressive loss of muscle mass and strength, a biological process resulting from a reduction in muscle fiber size and number. It is commonly believed that type II fibers are preferentially affected during aging, while type I fibers are relatively preserved. However, it has to be acknowledged that many controversies on this preferential type II atrophy and loss with aging exist in the literature. The objective of the present study was to investigate the effects of aging and physical activity on skeletal muscle fiber type proportion and size.

**Methods:** Fifty-three men, aged from 20 to 94 years old (yo), were divided into 3 groups: Young Adult, Middle-Age and 65 yo and older (65+). Middle-Age and 65+ participants were further divided into subgroups: Active (ACT), sedentary (SED) and pre-frail (PF). Physical activity levels were assessed using self-reported activity. Biopsies of the Vastus lateralis muscle were performed. Muscle cross-sections were cut and immunolabelled for the 3 myosin heavy chains expressed in human skeletal muscles.

**Results and Conclusions:** As could be expected, participants in the 65+SED and 65+PF groups displayed signs of significant muscle atrophy. In contrast, no significant muscle atrophy was observed in our 65+Act group. Neither aging nor physical activity had significant effects on type I and I lx fiber sizes and proportions. Overall our results indicate that aging-related changes in skeletal muscle phenotype are more complex than commonly acknowledged and that physical activity partly prevents aging-related changes in skeletal muscle phenotype in men.

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**Pain interferes with a cognitive task - evidence for gender effects in the tradeoff between pain and task processing**

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**Introduction.** Women are at higher risk of developing chronic pain, which is known to impact cognitive performance.

Conversely, engaging in cognitive activity inhibits pain, suggesting a shared resource model of cognitive task and pain processing. It is unclear whether there are gender differences in attentional modulation of pain. We propose that women are less able to inhibit pain when engaging in a demanding task, and that their task performance will be more impacted by pain. Psychological and cardiovascular gender differences have previously been proposed to mediate gender effects in pain experience and are examined as predictors of this tradeoff in the present analysis.

**Methods.** 22 women and 20 men (mean age 24, SD 4.74) were tasked to complete a working memory task (*2-back*) while receiving painful thermal stimuli, the parameters of which were individually calibrated for task difficulty and pain intensity beforehand. Psychological factors and cardiorespiratory fitness were measured with self-report questionnaires.

**Results.** For women, high task performance inhibited pain significantly more than for men ( $\beta = .089$ ;  $p = .004$ ); high pain perception impacted task performance significantly more in women than in men ( $\beta = .118$ ;  $p = .010$ ). Men from our sample had higher cardiorespiratory fitness and lower anxiety than women. Gender effects remained after controlling for cardiorespiratory fitness but were eliminated after controlling for anxiety.

**Conclusion.** Women experienced a larger task performance-related analgesia but also a larger negative impact of pain on task performance, effects that may be mediated by their higher anxiety but not their lower cardiorespiratory fitness.

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**An examination of the effects of physician counseling and other psychological factors on physical activity levels during pregnancy**

Workun-Hill, Michelle., Da Costa, Deborah., Duncan, Lindsay.

Theories and Interventions in Exercise Psychology (TIE) Lab & McGill University Health Center (MUHC)

**Introduction:** Studies have consistently demonstrated benefits of exercise on maternal physical and mental well-being as well as on birthing and infant outcomes. We examined the influence of patient/physician interactions and other psychological factors on physical activity in the first two trimesters of pregnancy.

**Methods:** Pregnant women over 18 years of age (N = 168) completed online questionnaires during the first and second trimester of pregnancy as part of an ongoing prospective study extending until the 6 months postpartum. Second trimester physical activity was regressed on self-efficacy for exercise, physician counseling, perceived benefits and barriers to physical activity, and pregnancy-related distress, controlling for first trimester physical activity and pregnancy-related discomfort.

**Results:** After controlling for first trimester physical activity and symptoms of pregnancy-related discomforts ( $R^2$  adjusted = .46,  $p < .001$ ), pregnancy-related distress (standardized  $\beta = .24$ ,  $p = .033$ ) and physician counseling (standardized  $\beta = .11$ ,  $p = .049$ ) were both positive predictors of second trimester physical activity ( $R^2$  change = .06,  $p = .001$ ). Self-efficacy for exercise and perceived benefits and barriers did not contribute significantly to the prediction of second trimester physical activity ( $p < .05$ ).

**Conclusion:** The finding that pregnancy-related distress predicted physical activity suggests that women with more pregnancy related worries and anxieties may be hesitant to engage in exercise during pregnancy. Further, physician counseling regarding physical activity seems to be a key factor towards keeping pregnant women active, and should be encouraged and made a priority throughout doctor/patient interactions.

**Effects of moderate exercise and dissonant music on acute salivary cortisol and  $\alpha$ -amylase fluctuations.**

**Authors:** Azadeh Ghassemi<sup>1,2,6</sup>, Alfredo Cosentino<sup>1,3</sup>, Marylen Youssef<sup>1,2,6</sup>, Tanya Babiuk-Henry<sup>1,2,6</sup>, Dmitri Sitnikov<sup>1,4</sup>, Dajana Vuckovic<sup>1,4</sup>, Peter J. Darlington<sup>1,2,5,6</sup>.

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**Abstract**

The influence of music and moderate exercise on in 14 healthy individuals was studied. To reduce the subjectivity aspect of music, a dissonant piece of music that was unfamiliar to participants was selected. Biomarkers of the Hypothalamus-Pituitary-Adrenal (HPA) axis and sympathetic nervous system (SNS) activity were measured from saliva samples. The biomarkers included salivary cortisol and salivary alpha amylase (sAA) which are part of the HPA and SNS axis, respectively. The subjects did the following four activities:

1. Moderate exercise (stationary cycling at 60% of  $VO_2$  max)
2. Listening to dissonant music
3. Listening to dissonant music during moderate exercise (stationary cycling at 60% of  $VO_2$  max)
4. Resting on stationary bike without pedaling and without listening to music

Saliva samples were collected prior to, 5 minutes after, and 30 minutes after the activity. The effect of variable activity was not statistically significant, as repeated F-tests uniformly displayed p-values well above the significance level of 0.05. However, a significant main effect of time was observed. Salivary cortisol levels decreased over time in each group, with  $F(2, 26) = 9.216$  and  $p\text{-value} = .001$ , according to the F-test assuming sphericity. Next, we considered a two-way ANOVA with one within-subject factor (Time) and one between-subjects factor (Music). Music was not statistically significant with respect to salivary cortisol, with  $F(1, 12) = 0.162$  and  $p\text{-value} = 0.695$ . For sAA, a trend of increase was observed after listening to dissonant music for 30 minutes. In contrast, sAA was not altered by exercise, or the combination of exercise and music. Findings indicate that changes in salivary concentrations of SNS or HPA markers within the timeframe of the experiment were not significant, while dissonant music invokes an acute SNS response without altering the HPA axis.

**Modulation of Helper T Cells by P2-Adrenergic Receptor Ligands.**

**Carvajal Gonczi, Catalina M.<sup>1,3</sup>, Tabatabaei Shafiei, Mahdieh<sup>1,3</sup>, Darlington, Peter J.<sup>1,2,3</sup>**

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**Abstract:**

T helper (Th) cells protect the body against infections, however, one type of Th cell called the "Th17 cell" can be a risk factor for developing autoimmunity. Understanding how Th17 cells are regulated is important because it will allow for the development of new therapies for treating autoimmune diseases. The purpose of this study is to determine the effect that the beta2- adrenergic receptor (P2AR) has on Th17 cells. The ligands of P2AR include endogenous catecholamine hormones that are involved in stress and exercise, and a number of agonist and antagonist drugs that stimulate or inhibit this receptor, respectively. Our results are that agonists of the P2AR raise the level of Th17 cell responses in samples of immune cells taken from healthy subjects ( $p < 0.01$ ). Surprisingly, a proportion of the healthy subjects' samples showed an opposite response, that is, P2AR agonists suppressed their Th17 responses ( $p < 0.05$ ). These effects were specific for the P2AR because the agonist (terbutaline) is a P2AR-specific agonist, and the effects could be blocked by a P2AR-specific antagonist (ICI-118-551). The diverse response to P2AR agonists observed between people may be explained by natural genetic variations in P2AR genes, an idea that we are currently investigating. The relevance of this work is to provide a better understanding of how genes and hormones interact with the immune system and influence predispositions to autoimmunity.

## **Regulation of Glycogen in Immune Cells by Activation and Hormone Signal**

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### **Abstract**

T cells are important players for protecting the body against infections; upon activation, they coordinate the adaptive responses to infections. While protecting the body, T cells must consume large amounts of energy in the form of glucose. We recently demonstrated that human immune cells store glucose as glycogen inside their cytoplasm. Glycogen is a branched polymer of glucose that can be broken down by the hormone norepinephrine to yield energy. The aim of this project is to determine what happens to glycogen when an immune cell is activated and whether or not hormone signals will modulate glycogen concentrations during an immune response. Results: activated immune cells accumulated more glycogen over time than immune cells that were not activated (resting immune cells). This occurred because the cells were grown in a nutrient rich microenvironment containing high levels of glucose. Hormone signals promote glycogen breakdown into glucose in activated T cells. These preliminary results suggest that immune cells take up more glucose than their metabolic demands and invest the energy into glycogen storage for future consumption. Furthermore, hormone signals are one of the factors that can release energy from glycogen stores during an immune response.

**Thyroid hormone mediation of T cell proliferation and apoptosis; implications for hypothyroidism and hyperthyroidism.**

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**Abstract**

Hypothyroidism and hyperthyroidism affect 5.9% of people over the age of 12. These conditions result in symptoms such as weight gain, lethargy, and memory problems. It is not known how dysregulation of thyroid hormones such as triiodothyronine (T3), impacts the immune system. T cells are part of the immune system. To fight infections, they proliferate, exert their function, and then die when they are no longer needed. How thyroid hormones alter the proliferation and subsequent apoptosis of T cells is not completely understood.

A laboratory model system was used to study the interactions between T3 and T cells. Jurkat T cells were cultured at suboptimal nutrient levels in growth media containing different levels of T3. In order to assess T3 activity on proliferation and apoptosis of Jurkat T cells, flow cytometry-based techniques were used. Adding 10 pg/mL of T3 to culture media increased cell survival rates over a 20-day period ( $p < 0.05$ ) and allowed the cells to utilise alternative energy sources (such as beta-oxidation). When 2 pM of palmitic acid and 10 pg/mL of T3 were added the cultured cells, T cells survived better than with palmitic acid alone ( $p < 0.05$ ).

T3 supports the growth and survival of T cells when they are grown at suboptimal nutrient levels, this is due to enhanced use of free fatty acids for fuel. This work has implications for how hypothyroidism and hyperthyroidism, impacts the proper functioning of immune system. Low thyroid hormones levels could suppress the immune system, while high thyroid hormones could result in a more active immune system.

## II. Nutrition

Poster #33

### A Cluster of RCT Evaluating the Effect of Iodized Salt on Infant Development in Amhara Region of Ethiopia

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Iodine has been associated with the physical and mental development of children. We examined the effects of iodized salt on the growth and mental development of infants. Forty-four communities in the Amhara region were randomly assigned and had access to iodized salt early (intervention) or later through market forces (control). A total of 1220 pregnant women were recruited and their health and micronutrient status were assessed at enrolment. Data were collected on infants (2 to 13 mo), including SES, diet, anthropometry, Hb, home stimulation, and mental development (Bayley scales: cognition, expressive language, receptive language and fine motor scales). The median UI excretion was higher in the intervention vs controls, for both mothers during pregnancy (161 vs 121 pg/L,  $p < 0.0001$ ) and infants (141 vs 110 pg/L,  $p < 0.02$ ). Additionally, (45 vs 60%,  $p < 0.05$ ) of mothers and (37 vs 44%,  $p < 0.05$ ) of infants were iodine deficient. The intervention improved cognition with an effect size of 0.10 ( $p = 0.04$ ), but did not affect the scores for the other three Bayley scales. The intervention significantly improved HOME score ( $\Delta = 0.45$ ,  $p = 0.04$ ). Iodised salt intake improved iodine status of both pregnant women and their infants, and lead to improved infant cognitive development.

Funded by Micronutrient Initiative, Canada

**Keywords:** Iodized salt, pregnant women, mental development

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**Vitamin D Status and Functional Health Outcomes: A Randomized Vitamin D Dose-Response Trial in 2-8 y Olds**

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Dietary vitamin D (VTD) intake is low in Canadian children. The objective was to conduct a dietary VTD dose-response in healthy children using specially fortified dairy products to reach the Estimated Average Requirement (EAR) and Recommended Dietary Allowance (RDA). Participants 2 to 8 y (n=77; Montreal), were randomized to 1 of 3 VTD targets (control, 400, 600 IU/d) for 12 wk in winter. At 0 and 12 wk anthropometry, demographics, dietary intakes, fasting serum parathyroid hormone (PTH), 25-hydroxyvitamin D (25(OH)D; Liaison, Diasorin) and ionized calcium (iCa; Radiometer), were compared using ANOVA. Participants (75/77) were  $5.1 \pm 1.9$  y (mean  $\pm$  SD), 54.5 % male, with BMI z-scores  $0.50 \pm 0.85$ . At 12 weeks, 25(OH)D in EAR/RDA groups significantly differed from control ( $p < 0.05$ ) (Control:  $55.8 \pm 12.3$ , EAR:  $64.1 \pm 10.0$ , RDA:  $63.7 \pm 12.4$  nmol/L). VTD intake significantly increased ( $p < 0.05$ ) over 12 weeks in EAR/RDA groups (EAR 0 wk:  $164 \pm 110$ , 12 wk:  $379 \pm 152$ , RDA 0 wk:  $253 \pm 220$ , 12 wk:  $514 \pm 324$  IU/d). VTD intake didn't alter PTH or iCa. These data suggest increasing dietary VTD intake improves winter VTD status of healthy children without affecting calcium homeostasis. Presented in part: Brett N, Lavery P, Agellon S, Vanstone C, Maguire J, Rauch F, Weiler H 2014 [Vitamin D dose-response in young children 2 to 8 y of age: a 12 wk randomized clinical trial to establish requirements in the absence of ultra-violet beta solar radiation. *J Bone Miner Res* 29 (Suppl 1).]

### Functional Brain Changes Associated with Weight Loss

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For most adults, dieting does not result in sustainable weight-loss. In order to investigate if functional brain changes can contribute to this phenomenon, we investigated how the neural response to food cues changes as weight-loss progresses over three months.

30 adults enrolled in a three-month weight loss program based on calorie restriction (1 M; mean BMI: 30.9±3.6, range: 25-41). Subjects underwent fMRI while viewing food and scenery images at three time points: at the start, at 1 month, and at 3 months.

The average BMI of the weight-loss study participants decreased over the 3 month period from 30.9 to 29.3 ( $F(1.3,24.8)=40.34$ ,  $p<0.001$ ). Compared to the baseline, at one month, participants showed reduced activation in the ventromedial prefrontal cortex, a brain region that has been implicated in reward valuation. In addition, people who lost more weight showed increased activation in the right inferior frontal gyrus (IFG) – a region involved in self-control. However, at three months the activity of the IFG returned to baseline levels despite continuous weight loss.

These results suggest that while the initial weight-loss was associated with greater activity in self-control regions, this response returned to baseline at 3 months post-paradigm initiation. This change may contribute to reduced control over food intake and to subsequent weight re-gain in long-term.

**Dietary habits and lifestyle of mothers with preeclampsia: a case control study from Serbia**

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Healthy dietary and lifestyle behaviors in pregnancy are important factors for fetal growth and development and as preventing the risk of pregnancy related diseases such as preeclampsia (PE).

The objective of this study was to determine if dietary habits and lifestyle of mothers is associated with PE. A case control study (n=60) of pregnancies with (case) and without (control) PE was conducted in the winter, when incidence of PE is higher in Serbia. A validated questionnaire was used to assess dietary habits, behaviors and physical activity in a month prior to delivery. Differences between groups were tested with ANOVA and Bonferroni post hoc tests, P<0.05.

Divergence dietary patterns of case vs. control (Table 1) were reflected in doubled intake of meat and grain food servings without meeting recommendations for daily vegetable, fruit and milk servings. Consumption of meat on a daily basis was high (case=192 g/day; control=151 g/day) compared to fish consumption (case=44 g/day; control=45 g/day) together with a high amount of oil used for cooking (case=194 ml/day; control=182 ml/day) and chocolate (case=40 g/day; control=21 g/day). There were no reports of smoking during pregnancy, 13 mothers reported drinking a glass of wine weekly (case: 6; control; 7) while only one control mother exercised moderately and 3 women in control group reported taking a walk longer than 30 min/day during the last month of pregnancy.

These data underscore the need for prenatal educational interventions to decrease the health risks attributable to unhealthy lifestyle behaviors and eating patterns in pregnancy

**Table. Dietary intake of case and control women in the month before delivery**

Dietary intake per day <sup>a</sup>	Recommendations	Case n=30	Control n=30	P value
Macronutrients	Estimated Average Requirements <sup>1</sup>	Mean ± SD	Mean ± SD	
Energy KJ	<b>8000</b>	8719 ±1690	7837 ±1703	0.0901
Protein g	<b>71</b>	92 ±24	77 ± 22	0.0136
Fat g	<b>ND</b>	67 ±27	59 ± 23	0.312
Cho g	<b>135</b>	261 ±56	258 ± 76	0.3718

<sup>a</sup> Based on 30 days FFQ

<sup>1</sup> Dietary Reference Intake (DRI):(Barr 2006): Estimated Average Requirements Food and Nutrition Board, Institute of Medicine, National Academies

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**Vitamin D status in mothers with preeclampsia and their infants at delivery: a case control study from Serbia, a country without vitamin D fortification policy**

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Low 25-hydroxyvitamin D (25-OH-D) concentration and low activity in pregnancy increases the risk of preeclampsia (PE).

The objective of this study was to determine if vitamin D intake and status is associated with PE in a country without a vitamin D fortification policy. A case control study (n=60) of pregnancies with (case) and without (control) PE was conducted in Serbia in the winter. Maternal and cord blood obtained at delivery were measured for plasma 25-OH-D<sub>3</sub>, C3-epi-25-hydroxyvitamin D<sub>3</sub> (3-epi-25-OH-D<sub>3</sub>) and 24,25-dihydroxyvitamin D<sub>3</sub> (24,25-(OH)<sub>2</sub>D<sub>3</sub>) by LC-MS/MS. Group differences were identified using ANOVA and Bonferroni tests.

Vitamin D intake was not different between groups (Case: 292.9 ± 135.2 vs Control: 313.7 ± 183.8 IU/day). Women with PE delivered earlier and had significantly lower plasma 25-OH-D<sub>3</sub> and 3-epi-25-OH-D<sub>3</sub> at delivery than women without PE, while 24,25-(OH)<sub>2</sub>D<sub>3</sub> was similar in both groups. Case infants were of lower birth weight, not different in total plasma 25-OH-D<sub>3</sub> (Case: 9.38 ± 4.59 vs Control: 11.17 ± 4.58 ng/ml, p=0.057) concentrations but with a higher proportion of 3-epi-25-OH-D<sub>3</sub> (Case: 7.95 ± 1.11 vs Control: 7.01 ± 1.36 % of total 25-OH-D<sub>3</sub>, p=0.005). A high prevalence of vitamin D deficiency, as defined by plasma 25-OH-D < 12 ng/ml, was observed in 47% of all mothers and 77% of all infants. Walking >30 min/day in the month prior delivery was reported 13% of controls and 0% of PE group.

These data underscore the need for prenatal vitamin D supplementation in Serbia and further explanation for inactivity among women with PE.

**Table 1. Mothers' characteristics**

	Control group n=30		Case group n=30		P value
	mean	SD	mean	SD	
Age (years)	28.40	4.52	28.60	4.86	0.7379
Vitamin D intake Supplemental (IU/day)	196.30	142.72	173.30	163.86	0.478
Gestational age at delivery (weeks)	37.69	0.55	36.29	2.12	0.038
25-OH-D <sub>3</sub> (ng/ml)	16.08	5.65	11.24	5.12	0.005
3-epi-25-OH-D <sub>3</sub> (ng/ml)	0.70	0.21	0.51	0.23	0.013
24,25-(OH) <sub>2</sub> D <sub>3</sub> (ng/ml)	0.80	0.38	0.76	0.56	1.000

**Efficacy of dual-hormone artificial pancreas to alleviate the carbohydrate counting burden in type 1 diabetes: Randomized crossover trial**

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**Introduction:** Carbohydrate counting remains a complex task for many patients with type 1 diabetes. We examined if the artificial pancreas, delivering insulin and glucagon based on glucose sensor readings, could alleviate the burden of carbohydrate counting without degrading glucose control.

**Methods:** Twelve adults were recruited in a randomized three-way cross-over trial. Participants were admitted three times from 7AM until 9PM and consumed low carbohydrate (breakfast; Women 30g - Men 50g), medium carbohydrate (dinner; Women 50g - Men 70g), and large carbohydrate (lunch; Women 90g - Men 120g) meals. Glucose levels were randomly regulated by 1) conventional pump therapy; 2) artificial pancreas accompanied with prandial boluses matching the meal's carbohydrate content based on participant's insulin-to-carbohydrate ratios (artificial pancreas with carbohydrate counting); or 3) artificial pancreas accompanied with prandial boluses based on qualitative categorization (regular or large) of meal size (artificial pancreas alleviating carbohydrate counting).

**Results:** The artificial pancreas without carbohydrate counting achieved similar iAUC compared to with carbohydrate counting after the small ( $p=0.54$ ) and medium ( $p=0.38$ ) meals but yielded higher post-meal excursions after the large meal ( $p=0.004$ ). The artificial pancreas with and without carbohydrate counting yielded similar mean glucose ( $8.2 \pm 2.1$  and  $8.4 \pm 1.7$  mmol/L,  $p=0.52$ ), and both strategies resulted in lower mean glucose compared to conventional therapy ( $9.6 \pm 2.0$  mmol/L,  $p=0.02$  and  $p=0.03$ , respectively).

**Conclusion:** The artificial pancreas with qualitative categorization of meal size might reduce the burden of carbohydrate counting without compromising glucose control, but more categories of meal sizes would likely be needed to effectively control large meals.

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**THE EFFECTS OF THE TYPE OF PROTEIN SUPPLEMENTATION COMBINED WITH POWER TRAINING ON MUSCLE FUNCTION AND FUNCTIONAL CAPACITY IN ELDERLY MEN.**

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**RATIONALE**

Aging leads to physical disabilities and muscle quality (MQ: muscle strength [MS]/muscle mass [MM]) decline. Resistance training is efficient for improving body composition but not MQ. However, power training (PT) has been proposed to improve MQ. Protein supplementation (PROT) is also known to be able to improve muscle function (MF) and functional capacity in elderly men. However, there are controversies regarding the beneficial effects of combining PROT to exercise (little is known about PT) on MF in elderly men. Most of these controversies seem to be related to the type (vegetal versus animal; slow versus fast absorption) or dose of dietary proteins used during these interventions.

**GENERAL AIM**

To define if PT combined with a slow-absorbed dietary protein (PROT-S from casein) is more effective than PT combined with a fast-absorbed protein (PROT-F from milk) or PT alone in improving MF and functional capacity in elderly men.

**METHODS**

60 elderly men (means  $\pm$  SD;  $69 \pm 7$  yrs) were divided into 3 groups: 1) Placebo with PT (n=19); 2) PROT-S with PT (n=21); 3) PROT-F with PT (n=20). MM, handgrip and knee extensor MS, MQ, functional capacity (SPPB), dietary intake and total energy expenditure were measured pre- and post- interventions. The interventions consisted of 12 weeks of PT (3 times/week; 1h/session) combined with supplementation (Placebo or PROT-S or PROT-F; 30g/d).  $P \leq 0.05$  was considered significant.

**RESULTS**

At baseline, no difference was observed between groups. The 3 groups improved significantly their MM, MS, MQ and functional capacity in response to PT. However, no significant difference between groups was observed at the end of the PT.

**CONCLUSION:**

Adding PROT (regardless of the type of speed of absorption) to PT did not prove beneficial in improving MF and functional capacity as compared to PT alone in elderly men who ingested at least 0.8g/kgBW/d of dietary protein.

### **Trait Mindfulness and Health Behaviors in Pregnant Women**

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#### **Abstract**

**Introduction:** Maintaining a healthy diet and engaging in regular physical activity are important components of a healthy pregnancy. Mindfulness has been associated with positive health behaviors, but whether these findings extend to a pregnant population remains unknown. We examined the role of dispositional mindfulness with levels of physical activity, healthy diet, and psychosocial factors related to health behaviors during pregnancy.

**Methods:** In an ongoing prospective study, pregnant women were recruited from obstetric clinics affiliated with McGill University and community health clinics in Montreal. Women completed online questionnaires assessing demographic, pregnancy-related, lifestyle and psychosocial variables in the first (n=218), second (n=166), and third trimester (n=104). Dispositional mindfulness was assessed using the Mindful Attention Awareness Scale (MAAS). **Results:** No relationship between mindfulness and level of physical activity or healthy eating was found. Mindfulness was significantly associated with lower emotional eating and less perceived barriers to exercise in the first and second trimesters. Two hierarchical multiple regressions were computed to determine the role of mindfulness on exercise barriers and emotional eating in the first trimester. Dispositional mindfulness ( $B = 0.14$ ,  $P < .05$ ) remained significantly associated with perceived barriers to exercise in the first trimester, and a trend was observed for its association to emotional eating.

**Conclusion:** Mindfulness was associated with more positive attitudes related to healthy behaviours during pregnancy (fewer perceived barriers, increased self-efficacy, less emotional eating). These findings underline the importance for further studies to investigate mindfulness as a potential strategy for the promotion of healthy behavior during pregnancy.

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### III. SLEEP

Poster #41

#### Reliability of Youth- and Parent-Report of Sleep Duration with Ambulatory Polysomnography

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**Introduction:** Parent-report is a common source for children's sleep characteristics, but parents may not provide accurate information. Previous studies have found parents overestimate child sleep duration compared to actigraphy. However, there are inherent limitations associated with using actigraphy alone for sleep assessment. The study objective was to compare the reliability of youth- and parent-report of sleep duration with home overnight polysomnography (PSG).

**Methods:** Youth (N=38) aged 9 to 16 years (M=13.2, SD=2.0) participated in the Healthy Heart Project. Parents and youth answered questions about typical sleep duration on school nights and weekends. Each youth underwent a modified PSG consisting of EEG (FPZ), EOG, A2 ref, and ground electrodes. Pulse oximetry and respiratory volume were also monitored. PSG was performed at home on a school night (n=21) or weekend (n=17). Measures of Total Sleep Time (TST) and Sleep Period Total (SPT) were calculated from PSG. Intra-class coefficients (ICCs) were used to test the reliability between youth- and parent-report with PSG.

**Results:** Preliminary results indicate there was greater reliability on school nights, compared to weekends. For school nights, parent-report of sleep duration significantly corresponded with PSG, yielding strong consistency for TST (ICC=0.82) and SPT (ICC=0.88). Youth-report was fairly consistent for TST (ICC=0.33) and moderately consistent for SPT (ICC=0.52). For weekends, parent-report was fairly consistent for TST (ICC=0.40) and SPT (ICC=0.42). Youth-report was also fairly consistent for TST (ICC=0.36) and SPT (ICC=0.32). On average, SPT was 43 minutes longer on weekends, compared to school nights ( $t=2.20, p<.05$ ).

**Conclusions:** Findings suggest youth- and parent-report of typical sleep duration are reliable with PSG measures for school nights, but less so for weekends. Greater structure in routine on school days (e.g., consistent bed and wake times) may partly explain these findings.

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### **The Association between Screen Time and Sleep in Adolescents**

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**Introduction:** Poor sleep has been related to numerous health problems among youth including decreases in school performance and physical activity, and increases in mental health problems and obesity. Although current guidelines recommend no more than two hours a day, youth spend almost 8 hours a day in front of a screen, and there is growing concern that screen time (i.e., time spent in front of smart phones, TV and computer screens) may relate to sleep problems. This current study examines the relationship between different types of sedentary behaviours including screen time, and quantity and quality of sleep among youth.

**Methods:** Data were drawn from the AdoQuest study, a prospective cohort investigation of 1843 grade 5 students aged 10-12 years at cohort inception. The sample was drawn from a stratified random sample of schools of French-language schools with >90 grade 5 students in the greater Montreal area. This current cross-sectional analysis uses data collected in 2008-9 when participants were aged 14-16 years and in grades 8 or 9. Data on socio-demographic characteristics, sedentary behaviours, (frequent > 2 hrs a day) and sleep characteristics (quantity, quality) were collected from 1233 of the 1843 participants (67%).

**Results:** Frequent computer and telephone use were each independently associated with poorer sleep quality. Computer, videogame and telephone use were each independently associated with fewer minutes of sleep per night on average. Frequent computer, telephone and videogame use increased the likelihood of sleeping less than 9 hours per night.

**Conclusion:** Frequent videogame, computer and telephone use are related cross-sectionally to sleep quantity and quality. Health care providers may need to evaluate screen time in their young patients and discuss current guidelines for screen time with patients and their parents.

**Age-related changes in waking EEG coherent activity after 24 hours of sleep deprivation.**

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**Objective:** Waking EEG studies have shown enhanced intrahemispheric but decreased interhemispheric coherence after sleep deprivation. Compared to young adults, older individuals show smaller or similar effects of acute sleep loss on vigilance. However, no study has evaluated changes in cerebral connectivity after sleep loss in aging. This study compared intrahemispheric (INTRA) and interhemispheric (INTER) waking EEG coherence before and after sleep deprivation in young and middle-aged participants.

**Methods:** Fourteen young (6W;29.9±5.0) and 15 middle-aged (11W;51.3±5.0) healthy subjects participated in a 25-hour constant routine protocol. Two waking EEGs were recorded: after one hour of habitual wake time (BSL) and after 24-hours of wakefulness (PRIV). Magnitude squared coherence was computed in INTRA (F3-C3,F3-P3,F3-01, C3-P3,C3-01,P3-01) and INTER (F3-F4,C3-C4,P3-P4,01-02) pairs of electrodes for delta, theta, alpha, and beta frequency bands. ANOVAs 2groups\*2conditions were computed for each pairs and frequency bands.

**Results:** Compared to BSL, young subjects showed higher INTRA alpha coherence for F3-01 and C3-P3 in PRIV whereas no condition effect was found for the older participants. Furthermore, both age groups showed higher INTRA coherence in alpha for C3-01 and in delta for F3-01 in PRIV compared to BSL. For INTER coherence, both age groups showed, in PRIV compared to BSL, higher coherence in alpha for F3-F4 but lower coherence in beta for C3-C4 and in delta/theta for P3-P4 and 01-02.

**Conclusion:** Compared to the young, older subjects showed less prominent effects of the sleep deprivation on INTRA coherence whereas no age-related changes were found in INTER coherence. Future studies should evaluate how cerebral waking EEG connectivity during sleep loss is linked with vigilance and performance deterioration during aging.

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**Evaluating recognition memory in children  
referred for suspected obstructive sleep apnea**

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**Study Objective:** Our objective was to assess the extent of memory deficits in children referred for suspected obstructive sleep apnea (OSA).

**Methods:** Children with suspected OSA were recruited prior to a night of polysomnography. Children performed a brief facial recognition memory task: 1) Prior to bedtime in the sleep laboratory, the child was instructed to study faces; 2) In the morning, the child was presented with previously studied faces and foils not seen before. The child was asked to identify which faces they remembered. We assessed memory variables accuracy (%correct) and reaction time (RT, milliseconds) and sleep/respiratory metrics.

**Results:** Twenty-two children (13.1years+/-2.9) were included. Those with OSA (mixed/obstructive apnea-hypopnea index, MOAHI $\geq$ 1) vs. without OSA (MOAHI<1) had more respiratory-related arousals (p=0.02) but no difference in the oxygen desaturation indices. Regardless of OSA status, children showed greater accuracy in recognizing the faces studied compared to the foils (p<0.001). Pearson correlations revealed no associations between memory performance and respiratory variables (MOAHI, respiratory arousals, desaturations). There were no associations between RT and sleep variables (sleep staging and total sleep time). There was an association between increased sleep and better accuracy in memory performance. (r=0.45, p=0.04).

**Conclusion:** Our data suggest that OSA in children may not be associated with deficits in memory performance, when using a brief recognition memory task. We found a modest association between increased sleep duration and higher accuracy in memory performance. Future studies should determine whether sleep quantity in OSA is relevant in preventing a child's susceptibility to impairments in recognition and other types of memory.

**Brain Structural Abnormalities associated with Rapid Eye Movement Sleep Behaviour Disorder in Parkinson's disease**

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*Objective*'. Previous structural neuroimaging data in rapid eye movement sleep behavior disorder (RBD) have used limited sample sizes and reported inconsistent results. We used Deformation-Based Morphometry (DBM) analyses of Magnetic Resonance Imaging (MRI) data to detect neurostructural abnormalities associated with RBD in a large sample of Parkinson's disease (PD) patients.

*Methods*: We compared DBM differences between 69 PD with RBD (PD+RBD) and 240 PD patients without RBD (PD-RBD). Presence of RBD was based on the RBD Screening Questionnaire. MRI data were extracted from the Parkinson's Progression Markers Initiative (PPMI) database. DBM analyses were conducted on T1-weighted MRI images, and FDR thresholded at  $t > 2$ .

*Results*'. RBD was associated with smaller volumes in the pontomesencephalic tegmentum (PMT), thalamus, and putamen. Higher volumes were found in the superior temporal, cingulate, and lateral prefrontal cortices, as well as in the olfactory tract and bulb. No differences were found between the PD+RBD and PD-RBD groups in the substantia nigra, hippocampus or precentral gyrus, where comparisons between HC and PD already showed low volume observed in these regions with PD.

*Conclusion*: The present study highlights specific neural abnormalities associated with RBD in PD, in line with the key role of nuclei in the PMT for the control of muscle tone during REM sleep. They are also in agreement with the altered olfaction and depressive symptoms observed in PD+RBD. Structural alterations of the substantia nigra were found in PD, but independently from RBD.

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PS. This material *was* presented at the 22nd Congress of the European Sleep Research Society, Tallinn, Estonia, September 2014.

**Spindles and slow waves predict treatment responses to cognitive-behavioural therapy for chronic primary insomnia**

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**Objectives:** Up to **10%** of adult population complain of chronic insomnia with adverse effects on their quality of life. Cognitive-behavioural therapy for insomnia (CBT-I) is clinically effective in **60%** of patients. However, it is still unclear why the other **40%** are less responsive. Spindles and slow waves are two major brain oscillations during sleep that modulate sleep stability, and thus might contribute to pathophysiology and treatment response to CBT-I in chronic primary insomnia.

**Methods:** 19 primary insomniacs (14F, mean age 39 years) had a polysomnography, followed by 6 weeks of group CBT-I. Spindle (12-16Hz) and slow-wave activity (0.7-4Hz) were computed from C4-02 electroencephalography derivation during stages N2-N3 of non-rapid-eye-movement (NREM) sleep, across the whole night and for each NREM sleep period separately, and correlated with the changes in sleep quality, assessed by questionnaires from pre- to post-CBT-I (sleep-diary and Pittsburgh Sleep Quality Index, PSQI).

**Results:** Higher spindle density, during total NREM sleep and in NREM period1, correlated with improvement in sleep quality from PSQI following CBT-I ( $p=0.028$  and  $p=0.021$ , respectively). Also, greater spindle power at baseline during total NREM sleep correlated with improvement in sleep efficiency ( $p=0.047$ ) and decrease in wake after sleep onset ( $p=0.009$ ) from sleep diaries after CBT-I. Greater slow-wave activity during total NREM sleep correlated with decrease in sleep latency ( $p=0.039$ ) and increase in sleep efficiency ( $p=0.008$ ) from sleep diaries following CBT-I.

**Conclusions:** These data suggest that individual differences in sleep microarchitecture (spindles and slow-wave activity) modulate neurophysiological vulnerability to insomnia and a differential response to CBT-I.

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### **Sleep Quality and Rest-Activity Cycle in Patients with Chronic Obstructive Pulmonary Disease**

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**Objective:** To investigate sleep quality and the circadian rest-activity cycle in patients with chronic obstructive pulmonary disease (COPD) and explore the relationships with disease severity and prognosis.

**Methods:** Fourteen participants (9 men) with moderate to severe COPD had their disease severity (pulmonary function and exercise capacity) and prognosis (comorbidities and composite disease score) evaluated at Hopital du Sacre-Coeur de Montreal. Participants completed a daily sleep diary at home over one week and wore an accelerometer, which estimated measures of sleep and rest-activity.

**Results:** On average, participants were  $71 \pm 7$  years, spent approximately 8 hours in bed per night ( $478 \pm 52$  min) and had a sleep efficiency of  $80 \pm 9\%$ . No significant correlations were found between sleep and measures of disease severity or prognosis. However, significant relationships were observed between relative amplitude of the rest- activity cycle and sleep efficiency ( $r = 0.711$ ,  $p = .004$ ), percent sleep ( $r = 0.782$ ,  $p = .001$ ), sleep fragmentation ( $r = -0.671$ ,  $p = .009$ ) and wake after sleep onset ( $r = -0.802$ ,  $p = .001$ ). Individuals in the low amplitude subgroup (relative amplitude below the median split of 0.86) were more likely to be overweight, older, with greater dyspnea and worst prognosis (comorbidities and composite disease score) compared to those in the high amplitude ( $> 0.86$ ) subgroup.

**Conclusion:** Sleep efficiency suggests the presence of insomnia, but no significant correlation was found between sleep and COPD severity and prognosis. Low amplitude was associated with worst outcomes in COPD, as it has been observed in other disorders.

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## Physical Activity and Sleep in Chronic Obstructive Pulmonary Disease (COPD)

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**Rational:** Epidemiological studies have reported a bidirectional relationship between increased physical activity (PA) and better sleep quality. However, it is still unknown whether PA is related to sleep quality in patients with COPD. This study aimed to (1) describe daily PA and sleep quality, and (2) to explore the association between these two modifiable factors in patients with COPD.

**Method:** A convenience sample of 14 patients with moderate/severe COPD (FEV<sub>i</sub>: 58±8% pred.) aged 71±7years was used. PA and sleep characteristics (Total Sleep Time [TST], Sleep Efficiency [SE%], Wake After Sleep Onset [WASO], and Fragmentation Index [FI%]) were assessed via actigraphy for 7-consecutive days, 24hours/day. Data were analyzed from wake to bedtime for PA, and from bedtime to wake for sleep characteristics. On nights following the most and the least active day sleep characteristics were compared using paired t-test or Wilcoxon test, depending on data distribution. Using similar models, daily PA and PA in three equal tertiles were compared following the night with highest and lowest SE%.

**Results:** Participants had on average TST of 6.4±1.0h, WASO of 1.1±0.5h, SE of 79±4% and FI of 44±23%. TST was significantly higher on the most active day as well as on day with greatest PA in the 1<sup>st</sup> tertile. PA in the 2<sup>nd</sup> tertile of the day was significantly higher following the night with highest SE.

**Conclusion:** These findings suggest possible bidirectional association between PA and sleep in COPD patients. Better understanding between these lifestyle factors may have important health implications in COPD patients.

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**Turn off and turn in: the influence of television viewing and sleep on lipid profiles in children.**

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**Introduction:** Physical activity is beneficial to lipid profiles, however the association between sedentary behaviors and pediatric dyslipidemia remains controversial. Given that youth are increasingly engaging in sedentary pursuits and are sleeping 1 hour less compared to 20 years ago, we aimed to investigate whether various forms of sedentary behavior/sleep predict lipid profiles in children over a 2-year period.

**Methods:** Data from 630 children living in Quebec, with at least one parent with obesity (QUALITY cohort) were collected at both 8-10 years and 10-12 years. Sedentary behavior, sleep time and moderate-to-vigorous physical activity (MVPA) were measured using accelerometry. Sleep time was derived from accelerometer non-wear time. Screen time, computer/video game use and TV viewing over the past 7 days were self-reported. Adiposity was measured using DXA scan and carbohydrate/fat intake by dietary recalls. Outcomes included fasting total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol. Multivariable models adjusted for MVPA, fitness, adiposity and diet.

**Results:** Every additional hour of TV time at baseline predicted a 7.4% (95% CI = 3.9; 10.9) increase in triglycerides and 2.1% (95% CI = -3.7; -0.5) decrease in HDL. These findings held true for triglycerides after adjusting for adiposity, dietary carbohydrate and sugar-sweetened beverages. Every additional hour of sleep predicted a 4.1% decrease (95% CI = -7.9; -0.3) in LDL even after controlling for sedentary behavior and dietary fat intake.

**Conclusion:** Higher time spent engaged in TV watching and lower sleep appear to be deleterious to childhood lipid profiles over time, even when taking into account other major lifestyle habits.

## Reducing jet lag:

### A case study of knowledge translation

Jay A. Olson

**Introduction.** Jet lag occurs when circadian rhythms are misaligned with the environment. Its symptoms include sleep disturbances and fatigue; chronic jet lag is associated with digestive diseases and cancer. Research has shown that bright light exposure at particular times can reduce or prevent jet lag. Calculating these times, however, is difficult and thus rarely done. This project aimed to automate the calculations in order to improve knowledge translation of jet lag research. **Methods.** I surveyed the literature and built an algorithm that calculates the best times for light exposure to reduce jet lag. The timing depends on the number of time zones crossed as well as usual sleep and wake times. The algorithm was accessible through a web interface (JetLagRooster.com) in which travellers entered trip information to receive a jet lag prevention plan. At the time of its creation (2013), it was the only free and accessible application available to reduce jet lag. A popular science article and a university press release were used to publicise the project. **Results.** The application has since created 240,000 jet lag plans for travellers from 97% of the world's countries. It is now used by some airlines in their flight crew safety training. The project thus effectively increased knowledge translation of jet lag research. Another project has now started using a similar algorithm to reduce circadian disturbances in shift workers. **Conclusion.** Health research often lacks knowledge translation. This project demonstrates how technology can effectively disseminate and apply scientific findings to the public.

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### EEG spectral analysis of REM sleep in aging.

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**Introduction:** The topography of quantitative EEG (qEEG) during rapid-eye movement (REM) sleep is used to discriminate Alzheimer patients from controls (Petit et al. 1992) but less is known on REM sleep qEEG topography in normal aging. The aim of this study is to compare the quantitative EEG topography of REM sleep in young, middle-aged and elderly subjects.

**Methods:** Power spectral analysis of REM sleep EEG was performed for forty-six young (20-30yo), 38 middle-aged (40-60yo), and 16 elderly (60-70yo) subjects on prefrontal, frontal, central, parietal and occipital derivations. Absolute power in the delta, theta, alpha and beta frequency ranges were computed from 60 seconds of artifact-free REM sleep EEG signal. The EEG slowing ratio (delta + theta/alpha +beta) was also calculated.

**Results:** Compared to young subjects, both middle-aged and elderly subjects showed lower REM delta power for all derivations but this effect was less prominent in the prefrontal area. The elderly subjects displayed lower theta power than young subjects for. Elderly subjects also presented lower power in alpha and beta but only for the occipital derivation. Compared to young subjects, middle-aged and older subjects showed a smaller EEG slowing ratio.

**Discussion:** Contrary to the REM EEG slowing reported in Alzheimer's patient, normal aging was associated with a faster REM sleep EEG ratio, supporting the notion that REM sleep slowing in dementia does not reflect "accelerated" aging. Further research should evaluate links between age-related changes in REM sleep EEG and cognition.

## **Chronic parenting stress and negative mood: The role of sleep disturbances**

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Parents of children with an autism spectrum disorder (ASD) experience more chronic stress and depressive symptoms than parents of typically developing children and of children with other special needs. In addition, these parents often report sleep disturbances. Given that experimental studies suggest that sleep deprivation impairs emotion regulation, poor sleep may increase the risk for mood disturbances in the context of chronic parenting stress.

To better understand the role of sleep in the relationship between chronic parenting stress and negative mood, 67 parents of children with ASDs completed self-report measures of daily parenting stress, negative affect, and sleep quality (e.g., sleep efficiency, sleep dissatisfaction, fatigue, and extent to which sleep disturbances interfered with their ability to execute daily activities) for 6 consecutive days. Participants also completed a questionnaire assessing the frequency of depressive symptoms over the previous two weeks.

Hierarchical linear regression models revealed that all four indicators of sleep quality moderated the relationship between daily stress and negative mood, such that the association between increased parenting stress and increased daily affect was strongest for parents reporting the poorest sleep quality. Further, all indicators of sleep quality, except sleep efficiency, fully mediated the relationship between daily stress and depressive symptoms.

Consistent with emotion regulation theories of sleep, poor sleep may diminish parents' ability to cope with the daily challenges of living with a child with ASD thereby exacerbating the association between stress and negative mood. Interventions targeting sleep may be an important avenue in reducing psychological distress for these parents.

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### **The causal role of NREM2 sleep in sequential motor memory consolidation**

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Numerous studies have convincingly demonstrated that **sleep** plays a critical role in motor sequence learning consolidation. Yet there is no consensus regarding the **sleep stages** implicated in this type of memory consolidation. Evidences indicate that **NREM2 sleep, and spindle activity in particular**, are critical for motor memory consolidation to occur, but most of those studies are only correlational in nature.

To probe the possible causal role of NREM2, we conditioned a first group of participants ( $n = 25$ ) with a rose-like odor during learning of a sequence of finger movements, and re-exposed them to the odor during NREM2 sleep (Cond-NREM2). A second group ( $n = 23$ ) was conditioned with the same odor and was re-exposed during REM sleep (Cond-REM). Finally, a third group ( $n = 28$ ) was not conditioned, but was exposed to it during NREM2 sleep (NoCond). All subjects were retested in the morning. We found significant difference of gains in performance between the experimental groups ( $F_{2, 71} = 5.855, p = .004$ ). More precisely, the Cond-NREM2 group had significantly higher gains in performance than both, Cond-REM and Nocond groups. Also, Cond-NREM2 showed significant increases in sleep spindles characteristics when comparing periods of sleep before and during stimulation. We found that the change in frequency of sleep spindles during stimulation mediated the relationship between our experimental groups and the offline gains.

These findings strongly suggest that NREM2 sleep is **causally** implicated, through the activity of sleep spindles, in the consolidation of motor sequence memories.