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Beyond the Symptom: The Biology of Fatigue

September 27 – 28, 2021

Fatigue in neurological disorders: the sensory attenuation hypothesis

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Disclaimer and Disclosures

Disclaimer

This certifies that the views expressed in this presentation are those of the author and do not reflect the official policy of the NIH.

Disclosure

This certifies that I, Anna Kuppuswamy, have no financial relationship that is relevant to the subject matter of this presentation.

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Apathy and fatigue

Temporal Associations between Fatigue, Depression, and Apathy after Stroke: Results of the Cognition and Affect after Stroke, a Prospective Evaluation of Risks Study

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Robert J. van Oostenbrugge[b] Julie Staals[b] Frans R.J. Verhey[a] Pauline Aalten[a]

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RESEARCH ARTICLE Open Access

Apathy/depression, but not subjective fatigue, is related with cognitive dysfunction in patients with multiple sclerosis

Masaaki Niino[1*], Nobuhiro Mifune[2], Tatsuo Kohriyama[3], Masahiro Mori[4], Takashi Ohashi[5], Izumi Kawachi[6], Yuko Shimizu[7], Hikoaki Fukaura[8,9], Ichiro Nakashima[10], Susumu Kusunoki[11], Katsuichi Miyamoto[11], Kazuto Yoshida[12], Takashi Kanda[13], Kyoichi Nomura[9], Takashi Yamamura[14], Fumihito Yoshii[15], Jun-ichi Kira[16], Shunya Nakane[17], Kazumasa Yokoyama[18], Makoto Matsui[19], Yusei Miyazaki[20] and Seiji Kikuchi[20]

The associations between fatigue, apathy, and depression in Parkinson's disease

Skorvanek M, Gdovinova Z, Rosenberger J, Ghorbani Saeedian R, Nagyova I, Groothoff JW, van Dijk JP. The associations between fatigue, apathy, and depression in Parkinson's disease. Acta Neurol Scand 2015: 131: 80–87.

M. Skorvanek[1,2,3], Z. Gdovinova[1,2], J. Rosenberger[3], R. Ghorbani Saeedian[3,4], I. Nagyova[3,4], J. W. Groothoff[5], J. P. van Dijk[3,5]
[1]Department of Neurology, Safarik University, Kosice

Apathy and fatigue co-occur but are dissociable

Is effort-reward trade-off a result or driver of fatigue?

Effort but not Reward Sensitivity is Altered by Acute Sickness Induced by Experimental Endotoxemia in Humans

Amelia Draper[1], Rebecca M Koch[2], Jos WM van der Meer[3], Matthew AJ Apps[1], Peter Pickkers[2,5], Masud Husain[1,5] and Marieke E van der Schaaf[*,4,5]

[1]Department of Experimental Psychology University of Oxford, Oxford, UK; [2]Department of Intensive Care Medicine, Radboud University Medical Center, Nijmegen, The Netherlands; [3]Department of Internal Medicine, Radboud University Medical Centre, Nijmegen, The Netherlands; [4]Donders Institute for Brain, Centre for Cognitive Neuroimaging, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands

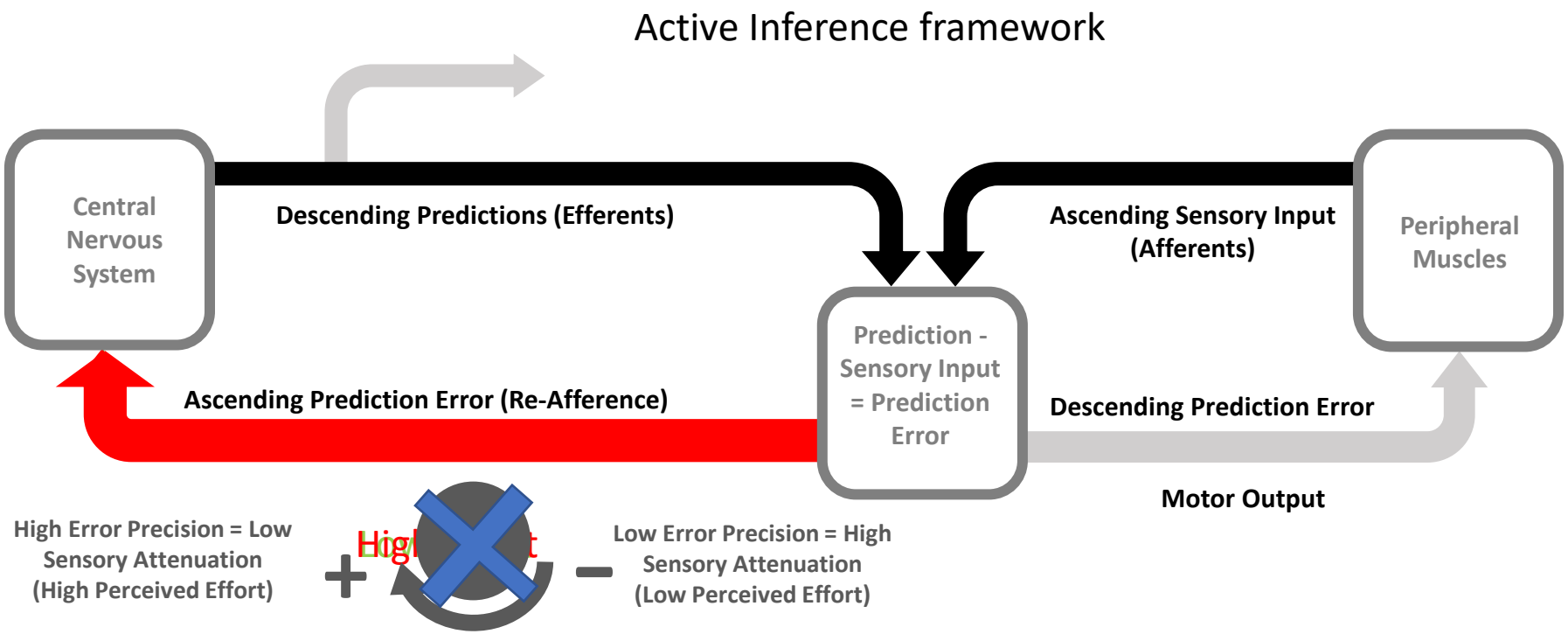
Dissociation between mental fatigue and motivational state during prolonged mental activity

*Mónika Gergelyfi, Benvenuto Jacob, Etienne Olivier and Alexandre Zénon**

Institute of Neuroscience, Université Catholique de Louvain, Brussels, Belgium

Fatigue maybe unrelated to changes in reward sensitivity, but related to perceived effort

Sensory attenuation (SA) model of fatigue – proprioception



<u>Greater perceived effort maybe explained by abnormal weighting of sensory prediction error</u>

The fatigue conundrum
Kuppuswamy, Brain, 2017

Behavioural evidence of SA in a motor task

ARTICLE OPEN ACCESS

Exploring the relationship between effort perception and poststroke fatigue

William De Doncker, MSc, Lucie Charles, PhD, Sasha Ondobaka, PhD, and Annapoorna Kuppuswamy, PhD

Neurology® 2020;95:e3321-e3330. doi:10.1212/WNL.0000000000010985

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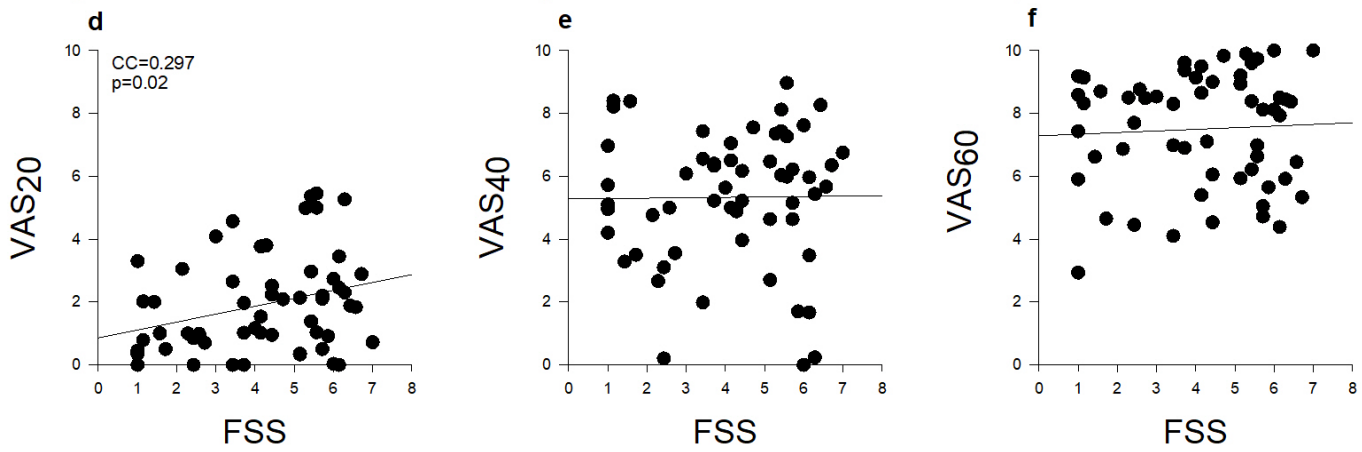


Altered perceived effort in fatigue can be explained by poor sensory attenuation

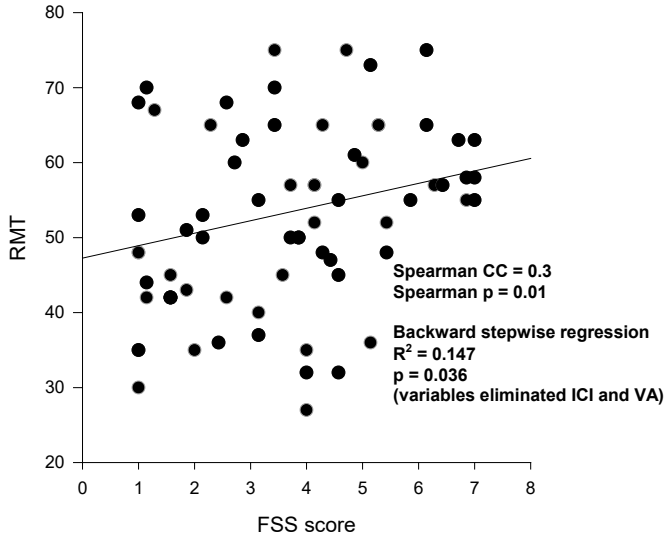
Neurophysiological evidence

doi:10.1093/brain/awu306 BRAIN 2015: 138; 136–148 | 136

BRAIN
A JOURNAL OF NEUROLOGY

Post-stroke fatigue: a deficit in corticomotor excitability?

Annapoorna Kuppuswamy, Ella V. Clark, Isobel F. Turner, John C. Rothwell and Nick S. Ward



Contents lists available at ScienceDirect

Clinical Neurophysiology

journal homepage: www.elsevier.com/locate/clinph

ELSEVIER

Influence of post-stroke fatigue on reaction times and corticospinal excitability during movement preparation

William De Doncker [a,*], Katlyn E. Brown [a,b], Annapoorna Kuppuswamy [a]

[a] Department of Clinical and Movement Neuroscience, Institute of Neurology, University College London, UK
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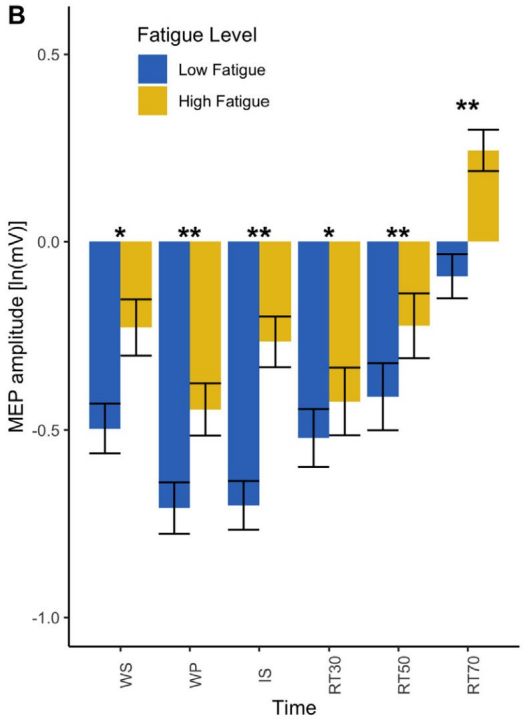
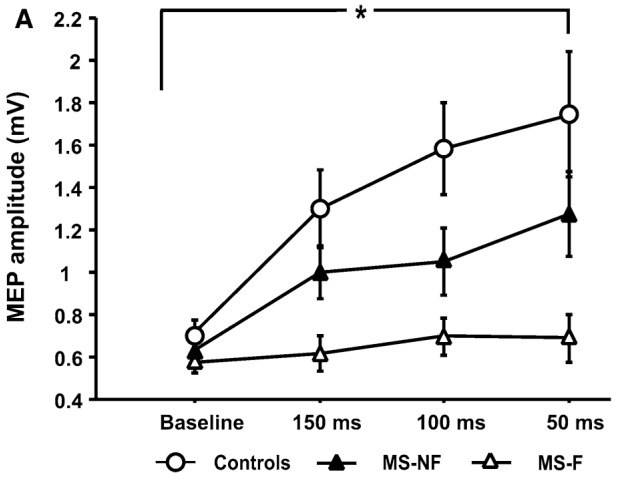


J Neurol (2011) 258:263–272
DOI 10.1007/s00415-010-5742-x

ORIGINAL COMMUNICATION

Is central fatigue in multiple sclerosis a disorder of movement preparation?

Francesca Morgante · Vincenzo Dattola · Domenica Crupi · Margherita Russo · Vincenzo Rizzo · Maria Felice Ghilardi · Carmen Terranova · Paolo Girlanda · Angelo Quartarone



Fatigue is associated with neurophysiological markers of poor behavioural flexibility

Visual and auditory effort

Disease Mechanisms

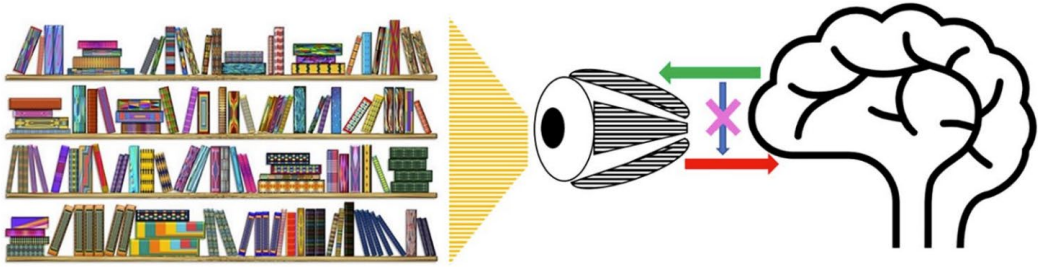
The Neurobiology of Pathological Fatigue: New Models, New Questions

The Neuroscientist
1–16

DOI: 10.1177/1073858420985447
journals.sagepub.com/home/nro
SAGE

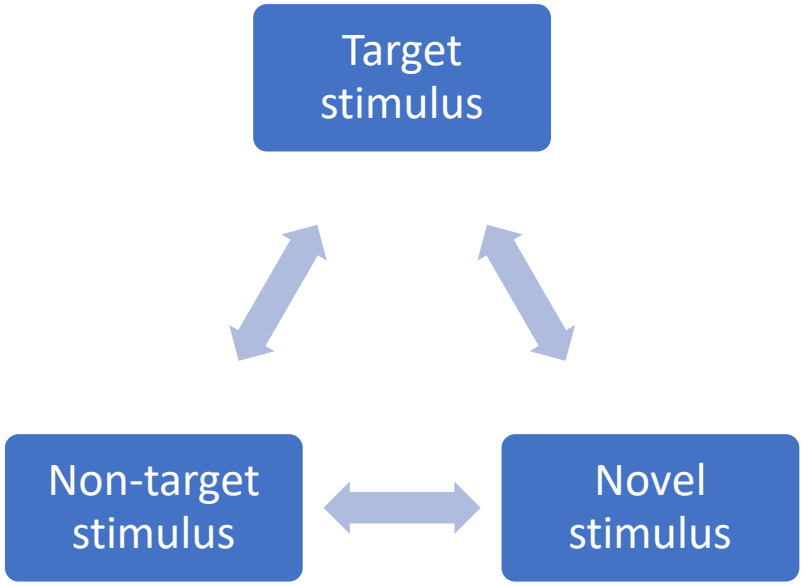
Annapoorna Kuppuswamy[1]

Poor Saccadic Suppression



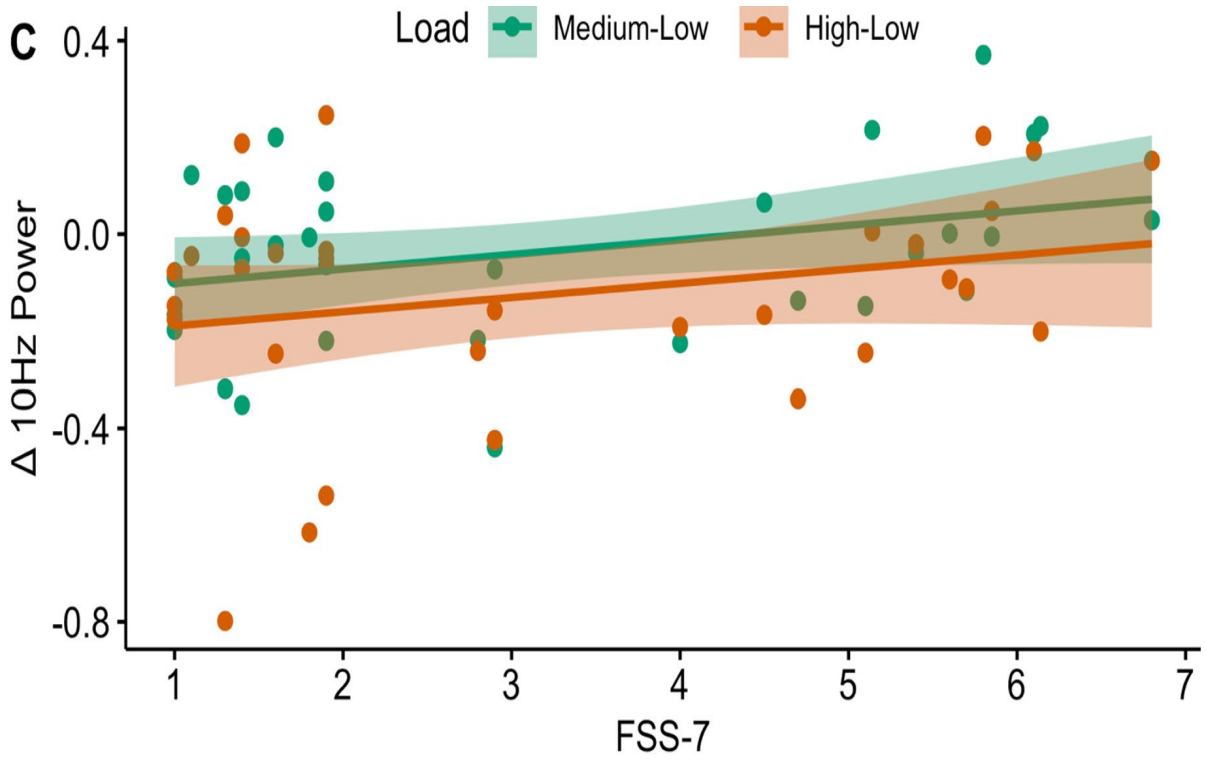
Can poor sensory attenuation also explain greater visual effort?

Perceptual load limitations



Can poor ability to switch attention explain visual and auditory effort?

Target Vs distractor stimulus processing in fatigue



Kuppuswamy et. al., 2021 in preparation

Clinical Neurophysiology 130 (2019) 692–700

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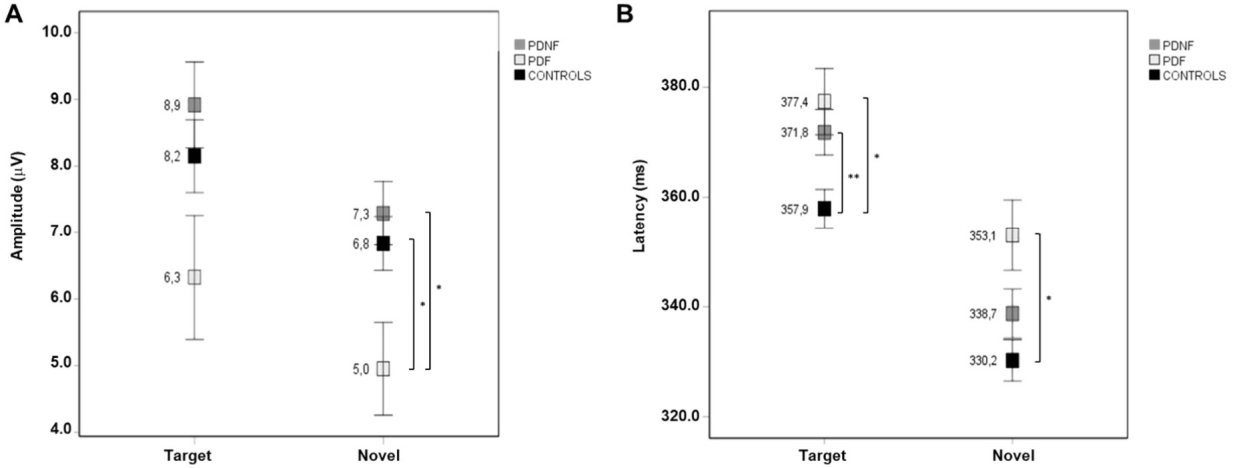
Clinical Neurophysiology

journal homepage: www.elsevier.com/locate/clinph

Central fatigue and attentional processing in Parkinson's disease: An event-related potentials study

Caterina Pauletti [a,b,*], Daniela Mannarelli [a], Nicoletta Locuratolo [a], Antonio Currà [c], Lucio Marinelli [d,e], Francesco Fattapposta [a]



Inability to switch attention from distractor to target with increasing load explains fatigue

◆ Human Brain Mapping 38:283–292 (2017) ◆

Fatigue in Parkinson's Disease: The Contribution of Cerebral Metabolic Changes

Sang Soo Cho,[1,2] Kelly Aminian,[1,2] Crystal Li,[2] Anthony E. Lang,[3] Sylvain Houle,[2] and Antonio P. Strafella[1,2,3]*

ORIGINAL ARTICLE

CNS Neuroscience & Therapeutics

Abnormal Resting-State Neural Activity and Connectivity of Fatigue in Parkinson's Disease

Jie-Jin Zhang,[1] Jian Ding,[1] Jun-Yi Li,[1] Min Wang,[2] Yong-Sheng Yuan,[1] Li Zhang,[1] Si-Ming Jiang,[1] Xi-Xi Wang,[1] Lin Zhu[1] & Ke-Zhong Zhang[1]

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2 Department of Radiology, The First Affiliated Hospital of Nanjing Medical University, Nanjing, China

OPEN

Post mTBI fatigue is associated with abnormal brain functional connectivity

eptember 2015
18 January 2016

Love Engström Nordin[1,2,*], Marika Christina Möller[3,4,*], Per Julin[3,5], Aniko Bartfai[3], Farouk Hashim[2,6] & Tie-Qiang Li[1,2]

Fatigue is associated with abnormal activity in resting state salience networks

Future directions

- Investigate reward prediction errors and sensory prediction errors in the context of trait fatigue and fatigability in disease.

- When investigating sensory attenuation – focus on all sensory inputs, not just somatosensory.

- When studying sensory perception, focus on proprioceptive, visual and auditory inputs, and multi-sensory integration.

Acknowledgements

The Effort Lab

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Prof John Rothwell
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Dr Anthony Harris
Dr Katlyn Brown