

● LETTER TO THE EDITOR

Human survival and immune mediated mitophagy in neuroplasticity disorders

Dear editors,

Neurodegenerative diseases are now associated with the global obesity and diabetes epidemic in the developing and developed world. Neurodegenerative diseases are a heterogeneous group of disorders with complex factors such as neurohumoral, endocrine and environmental factors involved in induction of these neurodegenerative diseases. The future of science and medicine in neurodegenerative diseases is now dependent on nutritional genomics with insulin resistance a major factor in the induction of neurodegenerative diseases. Nutritional genomics now involves the anti-aging gene Sirtuin 1 (Sirt 1) that is important to the prevention of insulin resistance with its critical involvement in the immune system (Martins, 2018a, b). Sirt 1 inactivation leads to toxic immune reactions connected to the acceleration of neuron death in various communities. Appetite control with relevance to immunometabolism has become of critical importance to the treatment of neurodegeneration (Figure 1). Nutritional diets activate the heat shock gene Sirt 1 to prevent the increase in heat shock proteins connected to autoimmune disease, mitophagy (Martins, 2018a, b) and irreversible programmed cell death in global populations (Figure 1).

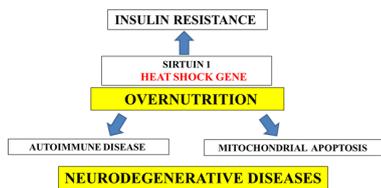


Figure 1 Overnutrition associated with Sirtuin 1 repression is a major factor involved with insulin resistance and the induction of neurodegenerative diseases. In the brain heat shock gene Sirtuin 1 inactivation is associated with autoimmune disease, mitophagy and accelerated neurodegenerative disease.

Sirt 1 is a nicotinamide adenine dinucleotide dependent class III histone deacetylase that targets transcription factors to adapt gene expression to metabolic activity and the deacetylation of nuclear receptors indicate its critical involvement in insulin resistance and neurodevelopment. Regulation of Sirt 1 (acute phase protein) by nutrition is essential to maintain neuron proliferation. Sirt 1 is involved with the control of the circadian rhythm critical to the immune response in various chronic diseases. Sirt 1 is essential for mitochondrial biogenesis and cell proliferation in various cells. In the brain heat shock gene Sirt 1 inactivation leads to the formation of toxic immunogenic proteins that induce mitochondrial apoptosis and acute neuron death in neurodegenerative diseases.

Laboratory evaluation that involve early plasma Sirt 1 measurement is essential for the diagnosis and management of immune-mediated disorders with relevance to immune mediated control of synaptic plasticity and epileptic stroke. Environmental factors such as xenobiotics (Brown et al., 2005; Mandolesi et al., 2017; Martins, 2018c) and core body temperature have become important to neural plasticity with heat shock gene inactivation (Martins, 2018a) associated with mitophagy and neuron apoptosis. The structural organization of the brain (Vance et al., 2012; Shaffer, 2016) is connected to Sirt 1 interactions between neurons and synapses with Sirt 1 critical to neural stem cell renewal (Herskovits and Guarente, 2014; Cai et al., 2016).

Major interests in neurological rehabilitation have now indicated the involvement of the cytoskeleton in neuroplasticity disorders (Gordon-Weeks and Fournier, 2014) but Sirt 1 repression associated with mitophagy remains the major cause of accelerated neuron death in the brain of man and animals.

Human survival and autoimmune disease (Martins, 2018a, b) is now relevant to synaptic plasticity (Figure 2) and brain regeneration (Martins, 2017). Appetite control, core body temperature and diet are essential to maintain brain Sirt 1 levels and to prevent the generation of immunogenic lipids and proteins that induce mitophagy and programmed cell death. Nutritional genomics that involves the Sirt 1

regulation determines suprachiasmatic nucleus regulation (Martins, 2018a, b) that is now important to circadian clock control connected to the sleep-to-wake cycle, appetite, body temperature and hormone regulation (Dierickx et al., 2018). Suprachiasmatic nucleus defects and immunometabolism are now connected to the primary induction of mitophagy with the acceleration of neuroplasticity disorders in neurodegenerative diseases in the developed and developing world.

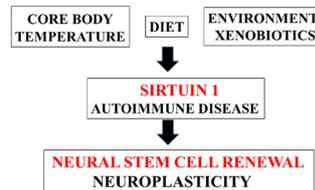


Figure 2 Factors that determine neuroplasticity determine the structural organization of the brain. Core body temperature, diet and xenobiotics repress the heat shock gene Sirtuin 1 with the induction of autoimmune disease with relevance to neural stem cell renewal.

Conclusion: Environmental factors such as core body temperature, xenobiotics and diet have become important to brain regeneration and with heat shock gene inactivation associated with mitophagy and neuron apoptosis in various species. Sirt 1 determines the fate of neural cells with diet and immunology now critical to the prevention of immune-mediated mitophagy and the promotion of neural stem cell renewal.

This work was supported by grants from Edith Cowan University, the McCusker Alzheimer's Research Foundation and the National Health and Medical Research Council.

Ian James Martins*

Centre of Excellence in Alzheimer's Disease Research and Care, Sarich Neuroscience Research Institute, Edith Cowan University, Nedlands, Western Australia, Australia; School of Psychiatry and Clinical Neurosciences, The University of Western Australia, Nedlands, Western Australia, Australia; McCusker Alzheimer's Research Foundation, Hollywood Medical Centre, Nedlands, Western Australia, Australia

*Correspondence to: Ian James Martins, PhD, i.martins@ecu.edu.au.

orcid: 0000-0002-2390-1501 (Ian James Martins)

Received: June 5, 2018

Accepted: September 21, 2018

doi: 10.4103/1673-5374.247482

Martins IJ (2019) Human survival and immune mediated mitophagy in neuroplasticity disorders. *Neural Regen Res* 14(4):735.

Conflicts of interest: None declared.

Open peer reviewers: Hans-Gert Bernstein, Otto-von-Guericke University Magdeburg, Germany; Sage Arbor, Marian University College of Osteopathic Medicine, USA; Anindita Banerjee, ICARE Institute of Medical Sciences and Research and Dr BC Roy Hospital, India. **Additional file:** Open peer review reports 1-3.

References

- Brown RC, Lockwood AH, Sonawane BR (2005) Neurodegenerative diseases: an overview of environmental risk factors. *Environ Health Perspect* 113:1250-1256.
- Cai Y, Xu L, Xu H, Fan X (2016) SIRT1 and neural cell fate determination. *Mol Neurobiol* 53:2815-2825.
- Dierickx P, Van Laake LW, Geijsen N (2018) Circadian clocks: from stem cells to tissue homeostasis and regeneration. *EMBO Rep* 19:18-28.
- Gordon-Weeks PR, Fournier AE (2014) Neuronal cytoskeleton in synaptic plasticity and regeneration. *J Neurochem* 129:206-212.
- Herskovits AZ, Guarente L (2014) SIRT1 in neurodevelopment and brain senescence. *Neuron* 81:471-483.
- Mandolesi L, Gelfo F, Serra L, Montuori S, Polverino A, Curcio G, Sorrentino G (2017) Environmental factors promoting neural plasticity: insights from animal and human studies. *Neural Plast* 2017:7219461.
- Martins IJ (2017) Dietary interventions reverse insulin and synaptic plasticity defects linking to diabetes and neurodegenerative diseases. *SL Nutrition and Metabolism* 1:1-15.
- Martins IJ (2018a) Heat shock gene inactivation and protein aggregation with links to chronic diseases. *Diseases* 6:E39.
- Martins IJ (2018b) Appetite control and biotherapy in the management of autoimmune induced global chronic diseases. *J Clin Immunol Res* 2:1-4.
- Martins IJ (2018c) Chapter 01. Increased risk for obesity and diabetes with neurodegeneration in developing countries. In: *Top 10 Contribution on Genetics*. Hyderabad, India: Avid Science.
- Shaffer J (2016) Neuroplasticity and clinical practice: building brain power for health. *Front Psychol* 7:1118.
- Vance DE, Kaur J, Fazeli PL, Talley MH, Yuen HK, Kitchin B, Lin F (2012) Neuroplasticity and successful cognitive aging: a brief overview for nursing. *J Neurosci Nurs* 44:218-227.

P-reviewers: Bernstein HG, Arbor S, Banerjee A; C-Editors: Zhao M, Yu J; T-Editor: Liu XL