Editorial

iMedPub Journals
www.imedpub.com

Translational Biomedicine
ISSN 2172-0479

2021
Vol.12 No.6:179

Research in Translational Neurology

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Citation: Dr. Run-Zhi Lai (2021) Research in Translational Neurology. Transl Biomed Vol.12 No.6:179

Received date: June 05, 2021; **Accepted date:** June 19, 2021; **Published date:** June 26, 2021

Abstract

Over the past 2 decades, functional imaging techniques have become commonplace in the study of brain disease. Nevertheless, very few validated analytical methods have been developed specifically to identify and measure systems-level abnormalities in living patients. Network approaches are particularly relevant for translational research in the neurodegenerative disorders, which often involve stereotyped abnormalities in brain organization.

Introduction

To illustrate the utility of network imaging in neurological research, we review recent applications of this approach in the study of Parkinson disease and related movement disorders. Novel uses of the technique are discussed, including the prediction of cognitive responses to dopaminergic therapy, evaluation of the effects of placebo treatment on network activity, assessment of preclinical disease progression, and the use of automated pattern-based algorithms to enhance diagnostic accuracy. Hereditary ataxia, or motor incoordination, affects approximately 150,000 Americans and hundreds of thousands of individuals worldwide with onset from as early as mid-childhood. Affected individuals exhibit dysarthria, dysmetria, action tremor, and diadochokinesia. The interdisciplinary analysis suggests that computational neurobiology can be an important tool for translational neurology. Computational systems neurobiology can be used to understand neuronal systems, based on utilizing information garnered from clinical reports, animal studies and in vitro modeling. Results from computational neurobiology can be used to develop additional animal and cellular experiments that may ultimately be translated to clinical practice, i.e., translational neurology. Clinical outcome was Dizziness Handicap Inventory score at recovery phase. Acute visual dependency and autonomic arousal predicted outcome. Worse recovery was associated with a combination of increased visual dependence, autonomic arousal, anxiety/depression and fear of bodily sensations, but not with vestibular variables. Findings highlight the importance of early identification of abnormal visual dependency and concurrent anxiety. Visual motion sensitivity and dizziness brought on by complex or moving visual surroundings are common in cross-sectional studies of chronically symptomatic vestibular patients4. Our prospective study shows that if too much weighting is placed on vision acutely or if sensory integration mechanisms are unable to down-regulate the visual contribution to the central compensation process, patients recover poorly. Extensive knowledge has been gained over recent decades about anatomic and pathophysiologic mechanisms governing saccades, rapid eye movements by which gaze is shifted between visual targets. In this focused review, we highlight the physiology and anatomy of normal saccades as they pertain to pathological saccade slowing of central brainstem origin, with emphasis on excitatory and inhibitory burst neurons and omnipause neuron function. Translational Neuroscience applies findings from fundamental laboratory research relating to brain structure and function to development of new therapies for neurodegenerative, neuropsychiatric and neurodevelopmental diseases. Translational Neuroscience looks at how laboratory research relating to brain structure and function informs the development of new therapies for diseases of the nervous system.

Conclusion

Translational Neuroscience is the process of using all technological advances to bring novel therapies with measurable outcomes to patients with neurological diseases. The concept is derived from the need to translate the wealth of basic understanding about neuroscience, neuropathogenesis, and neuroengineering into a trajectory that will realistically lead to therapies and measurable benefit to individuals at risk for or suffering from neurological disease. Many brain disorders are currently untreatable. It has been suggested that taking a 'translational' approach to neuroscientific research might change this. We discuss what 'translational neuroscience' is and argue for the need to expand the traditional translational model if we are to make further advances in treating brain disorders.