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Talk Title Neuronal firing patterns and circuitry oscillations in parkinsonian motor control
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1. Tentative Abstract

Neuronal oscillations at beta frequencies (20-50 Hz) in the cortico-basal ganglia circuits have been the leading theory for bradykinesia symptom of Parkinson disease (PD). This beta oscillation theory helped to drive a frequency-based design in the development of deep brain stimulation therapy for PD. On the other hand, increase in neuronal burst activities in the subthalamic nucleus (STN) is a well-documented electrophysiological feature of (PD). Intrinsic membrane properties of subthalamic neurons, especially T-type $\text{Ca}(2+)$ channels, play a key role in the genesis of burst discharges in STN, and parkinsonian locomotor symptoms. Delivery of negative constant current into STN depolarized subthalamic neurons by decreasing T-channel availability as well as burst discharges, and this effect dramatically ameliorated locomotor deficits in parkinsonian rats. Effective DBS therapy in PD very likely relies on adequate depolarization, and consequent modification of the relevant ionic currents and discharge patterns of STN neurons. Recent studies revealed that STN burst-firing and beta oscillations are resulted from two independent mechanisms regulated by different NMDA receptors in STN. These distinct mechanisms may improve understanding of the fundamental concepts of motor control in PD and enable more selective therapy targeting at different pathophysiological mechanisms to improve therapy of PD.

2. Brief Biography

Dr. Chun-Hwei Tai serves as an attending physician in the Department of Neurology at National Taiwan University Hospital (NTUH) since 2000. He is a neurologist with a special interest in the deep brain stimulation (DBS) therapy of Parkinson's disease (PD) and other movement disorders. Dr. Tai received his training on DBS in both NTUH and University Hospital Center (CHU) of Joseph Fourier University, at Grenoble, France (Professor Alim-Louis Benabid) in 2001. Dr. Tai also received training in basal ganglia research in University Bordeaux 2, Bordeaux, France (Dr. Abdelhamid Benazzouz) until 2002, and later in the Institute of Physiology, NTU (Dr. Chung-Chin Kuo). Dr Tai developed special movement disorder surgical program with Dr. Ruey-Meei Wu and Dr. Sheng-Hong Tseng, in the Center for Parkinson and Movement disorders in NTUH since 2004. Dr. Tai is currently the clinical assistant professor in neurology at National Taiwan University and also a council member of Taiwan Movement Disorder Society.

3. List of Representative Publications

1. Tai CH, Boraud T, Bezard E, Bioulac B, Gross C, Benazzouz A. Electrophysiological and metabolic evidence that high-frequency stimulation of the subthalamic nucleus bridges neuronal activity in the subthalamic nucleus and the substantia nigra reticulata. *FASEB J*. 2003 Oct;17(13): 1820-30.
2. Tai CH, Wu R-M, Lin CH, Pan MK, Chen YF, Liu HM, et al. Deep brain stimulation therapy for parkinson's disease using frameless stereotaxy: comparison with frame-based surgery. *Eur J Neurol*. 2010 Nov;17(11):1377-85.
3. Tai CH, Yang YC, Pan MK, Huang CS, Kuo CC. Modulation of subthalamic T-type Ca^{2+} channels remedies locomotor deficits in a rat model of Parkinson disease. *J Clin Invest*. 2011 Aug;121(8):3289-305.
4. Tai CH, Pan MK, Lin JJ, Huang CS, Yang YC, Kuo CC. Subthalamic discharges as a causal determinant of parkinsonian motor deficits. *Ann Neurol*. 2012 Sep;72(3):464-76.
5. Huang CS, Wang GH, Tai CH, Hu CC, Yang YC. Antiarrhythmics cure brain arrhythmia: The imperativeness of subthalamic ERG K(+) channels in parkinsonian discharges. *Sci Adv*. 2017 May 10;3(5):e1602272. doi: 10.1126/sciadv.1602272. (Co-first author)
6. Thevathasan W, Debu B, Aziz T, Bloem BR, Blahak C, Butson C, Czernecki V, Foltynie T, Fraix V, Grabli D, Joint C, Lozano AM, Okun MS, Ostrem J, Pavese N, Schrader C, Tai CH, Krauss JK, Moro E; Movement Disorders Society PPN DBS Working Group in collaboration with the World Society for Stereotactic and Functional Neurosurgery. Pedunculopontine nucleus deep brain stimulation in Parkinson's disease: A clinical review. *Mov Disord*. 2018 Jan;33(1):10-20. doi: 10.1002/mds.27098. Epub 2017 Sep 28. Review. PubMed PMID: 28960543.