Speaker	Yen-Chung Chang
Talk Title	Altered neural circuits in the primary motor cortex of hemi-Parkinsonian rats
Institution	National Tsing Hua University, Taiwan
Department	Institute of Systems Neuroscience
E-mail	lscyc@life.nthu.edu.tw
Webpage	http://life.nthu.edu.tw/~lscyc/

1. Tentative Abstract

Parkinson's disease (PD) is the second most common debilitating neurologic disease after Alzheimer's disease globally. By local field potential (LFP) recording, we have detected alterations in the activities in the primary motor cortex, M1, of un-anesthetized, freely moving hemi-Parkinsonian rats. These alterations include the presence of exacerbated oscillations in the β-regime and the more frequent appearance of high-voltage-spindle (HVS) episodes. Deep-Brain-Stimulation (DBS) targeting at regions lying deep in the brain, such as the subthalamic nucleus (STN), has been used to treat patients with advanced PD. Application of high frequency stimulation, 130 Hz, on STN in hemi-Parkinsonian rats could also attenuate the β-oscillation and HVS, as well as reverse the amphetamine-induced rotation, which is a characteristic movement of these rats. By using c-fos expression as an indicator of neuronal activity, we find that the induction of PD decreases the number of c-fos-positive cells in the M1 region on the lesion side, and this number is brought back to the control level after being treated with STN DBS. Together, our results indicate that alterations in the local circuit involving both inhibitory interneurons and excitatory PT neurons residing in L2/3 and L5 occur in the M1 region of rats after the dopamine in the subtantia nigra pars compacta (SNpc) on the same side is depleted. The altered circuit may allows STN DBS to activate corticospinal neurons and other neurons connected to corticospinal neurons and then to ameliorate the movement disorders as resulting from the degeneration of dopamine neurons in the SNpc.

2. Brief Biography

Dr. Yen-Chung Chang is Professor of the Institute of Systems Neuroscience and Adjunct Professor of the Department of Life Science and Institute of Molecular Medicine, National Tsing Hua University, Hsinchu, Taiwan. He received his PhD from the Department of Biochemistry and Biophysics, Iowa State University, USA. His research primarily focuses on investigating the subcellular proteomes of axons and the substructures of axons, growth cones and axonal shafts, of CNS neurons and the mechanism(s) regulating local protein synthesis in the axon. He has thus far developed a variety of micro devices and novel procedures for carrying out the above studies. More recently, he has joined a research team consisting of 10 professors from the Colleges of Engineering, Life Science and Electrical Engineering and Computer Science of Tsing Hua University and neurologists with Chang Gung Memorial Hospital who share a common interest in developing technologies of biomedical applications, including Brain-Machine-Interface and Deep-Brain-Stimulation. The applicability of the

developed devices are validated by using rats that model the Parkinson's disease.

3. List of Representative Publications

1. Orchard, G.; Meyer, C.; Etienne-Cummings, R.; Posch, C.; Thakor, N.; and Benosman, R., "HFIRST: A Temporal Approach to Object Recognition," Pattern Analysis and Machine Intelligence, IEEE Transactions on vol.PP, no.99, pp.1,1 (accepted, available in preprint)

2. Orchard, G.; and Etienne-Cummings, R. "Bioinspired Visual Motion Estimation" Proceedings of the IEEE, 102(10), 1520–1536, Oct 2014.

3. Orchard, G.; Martin, J.G.; Vogelstein, R.J.; and Etienne-Cummings, R., "Fast Neuromimetic Object Recognition Using FPGA Outperforms GPU Implementations," Neural Networks and Learning Systems, IEEE Transactions on, vol.24, no.8, pp.1239,1252, Aug. 2013

4. Orchard, G.; Lagorce, X.; Posch, C.; Benosman R.; and Galluppi, F. "Real-time Event-driven Spiking Neural Network Object Recognition on the SpiNNaker Platform" IEEE International Symposium on Circuits and Systems, special session on Real-Time Event-Based Sensor Processing, Lisbon, Portugal, May 2015 (accepted, to appear)

5. Ghosh, R.; Mishra, A.; Orchard, G.; and Thakor, V. "Real-Time Object Recognition and Orientation Estimation Using an Event-Based Camera and CNN", IEEE Biomedical Circuits and Systems, Lausanne, Switzerland, Nov 2014

6. Orchard, G.; Matolin, D.; Lagorce, X.; Benosman, R.; Posch, C. "Accelerated Frame-Free Time-Encoded Multi-Step Imaging", IEEE International Symposium on Circuits and Systems, Melbourne, Australia, June 2014

7. Orchard, G.; Benosman, R.; Etienne-Cummings, R.; and Thakor, N. "A Spiking Neural Network Architecture for Visual Motion Estimation," IEEE Biomedical Circuits and Systems, Rotterdam, Holland, Nov 2013.