Editorial

Special Issue on Parkinson`s Disease - Latest in Science (Part I)

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This special issue (part I) gives the readers some advanced machinery and the symptoms knowledge and how to choose the correct device for the better treatment especially neurology and neurosurgery disciplines.

Parkinson's disease (PD), one of commonest movement disorders, is caused by damage to the central nervous system (CNS). In spite of all the studies on PD, the formation mechanism of its symptoms remained not known. It is however not apparent a n d clear why damage only to the subthalamic-nucleus (STN) substantia-nigra (SN), a small (few millimeters) component of the brain, causing a wide range of cardinal motoric feature manifestations which are signs and symptoms. Furthermore, the causes of brain and/or nerve injuries or damages continue to be wholly elucidated. Exact understanding of the brain-function seems to be impossible.

Numerous hardware (H/W) and software (S/W) innovations in the field of deep brain stimulation (DBS) have been done in modern years and methods as of various companies are offered. The personal computer-based Percept™ (PC) platform – microelectrode recording with the STN-DBS in PDs (electrode implantations) enables brain sensing, the latest innovation. Neuro-clinical and neurosurgical scientists (neurologists, neurophysiologists, neurosurgeons, biomedical engineers, etc.) should be familiar with the differences in devices, and with the latest technologies to deliver optimized patient care. The following is the DBS device of Medtronic Inc.

Figure 1

This latest stimulus device enables with brain sense technology designed to acquire signals/waveforms of brain during stimulation asynchronously both within and outside the clinic. This was built ergonomically offering improved comfort for PD diseased subjects

who are patients with tremor, dystonia followed by epileptic-Seizures (e-Seizures). An individualized therapy delivered from a tiny device like a pacemaker, embedded underneath the skin-membrane of the chest (or abdomen), to send electric-potentials (bio-potentials/or biomarkers which are biosignals) through thin-wires (the macro-leads for macro stimulation, and also microelectrodes for micro stimulation) to a region of the PD brain (SN - STN and GP components lad-points) associated with the neurodegenerative symptoms and neurological disorder symptoms. By the latest PC based microelectrode recording (MER, based on MER signal patterns or signatures) with STN DBS technique, the neuroscientists - neurologists and neurosurgeons can track the patient brain signals/waveforms and correlate these with the subject (patient) recorded actions and activities or experiences like cardinal-feature manifestations (symptoms), dyskinesias (side-effects), dysarthria's (user or instrument effects) or via medication. This will allow for more personalized, data-driven neuro-stimulation treatment. Scientists are working towards devising meaningful innovations that harness the power of data to enhance overall care and efficacy.

The innovative engineering tools particularly advanced artificial intelligence-based machine learning models are trying to predict with supervised learning classification techniques and feature extractions through the unsupervised learning clustering techniques to understand the behavior and performance of complex systems, and to restore motor functioning and improve the functioning of the human motor control with these machines. Therefore, modeling is one of the most important tools in this regard. Developing quantitative models for this disease has begun in recent decades. They are very effective not only in better understanding of the disease, offering new therapies, and its prediction (prognostics) and control, but also in its early diagnosis and so prognosis. Modeling studies include black box which is designated as BB-models and gray box models which is designated as GB models. In the BB modeling, usually, regardless of the information of the system, the signs and symptoms are (only) considered as the output (o/p). Such models, besides the quantitative-analysis (QA) studies, improve our knowledge e and expertise of the diseased (and hence disordered) and disorders behavior and the symptoms of the disease. The GB models consider the involved structures in the symptom's appearance as well as the final disease symptoms. These models can effectively save time and be cost-effective for the scientists/researchers and help them select appropriate treatment mechanisms among all possible options. (Continue…in next issue of part II).