VII SERB School in Neuroscience-Focus on Electrophysiology

December 9-21, 2013, Centre for Neural and Cognitive Sciences,
University of Hyderabad

The VII SERB School in Neuroscience was organized by Dr. Joby Joseph, and Dr. Kaveri Rajaraman during 9-21 Dec. 2013 at the Centre for Neural and Cognitive Sciences, University of Hyderabad to encourage young neuroscientists. It was funded by SERB, Department of Science and Technology (DST), Govt. of India. Twenty two participants (Ph.D. scholars, postdoctoral fellows or young faculty members) of multidisciplinary areas from different institutes of India such as BHU, NBRC, IMSC, IISc, RTMU, IISER, RGC, DIPAS, PGIMER, NISER, University of Mysore, NCCS, JNU, NII, NIMHANS, and Mangalore University were selected with travel and accommodation support. 21 scientists and experts from India and abroad acted as resource persons for imparting training to participants.

The school was focused on understanding the nervous system with the help of electrophysiology tools. The whole training program was organized mainly into lectures and open discussion covering basics to advanced neuroscience, intensive hands-on lab sessions followed by tests and evaluation. The lecture sessions started with the basics of Neuroscience about neurons and nervous system and gradually dealt with the intricacies of higher level Neuroscience focusing on the current approaches used by neuroscientists to explain the complexities of nervous system. Profs. NK Subhedar and Aurnab Ghose (IISER Pune) discussed about evolution, development and organization of nervous system. Electrical and ionic properties of neurons with respect to action potential was elaborated by Prof. MK Mathew, NCBS Bangalore. The functional part of brain like sensory, motor, regulation and biological clock system was emphasized by Drs. Soumya Iyenger, Sharba Bandyopadhyay (NBRC Manesar), Kaveri Rajaraman (University of Hyderabad), Vatsala Thirumalai (NCBS Bangalore), and Prof. Vinod Kumar from University of Delhi. There are many types of synapses and they perform complex functions due to their plastic nature. The detailed lecture covering the topic of synaptic plasticity responsible for learning and memory was discussed by Prof. BSS Rao (NIMHANS), Drs. Kavita Babu (IISER Mohali), Mani Ramaswami (Trin-

ity college, Dublin), Monika Sadananda (St. Alloysius College, Mangalore). Critical events at the synapse during its function is difficult to notice, however, with the advent of cutting edge technologies, one can now observe the changes in the electrical property of neurons by sophisticated electrophysiological tools and patch clamping techniques and this was discussed by Drs. Rishikesh Narayanan (IISc Bangalore), Joby Joseph, (University of Hyderabad), and Suresh Jesuthasan, ASTAR Singapore. As the ethical issues have always been posing limitations to do all kinds of invasive studies with human brain, an alternative system where one can mimic the conditions of human brain, were used during hands-on trainings sessions. Drs. Vatsala Thirumalai, (NCBS Bangalore) and Kavita Babu, (IISER Mohali) emphasised the necessity of different animal model systems like *C. elegans*, grasshopper, zebra finch, rat, *Drosophila* and honey bee apart from the use of different genetic and molecular tools and techniques in modern neuroscience. Honey bee foraging behaviour and dance language communication was taught by Dr. Axel Brockman, NCBS Bangalore. The most attractive aspect of the school was the hands-on lab sessions which were really educative. The participants were encouraged to do as much as possible by themselves and there were no limits of time or the access to lab resources. The first day of the lab was moderated by Drs. Vidita Vaidya (TIFR Mumbai) and Soumya Iyenger (NBRC Manesar). This lab session dealt with giving us a high level exposure to comparative anatomy of vertebrate and invertebrate brain. We sliced the rat brain and tried to identify the main functional regions and their localization. Apart from it, participants were also shown the brain of Zebra Finch (a song bird) and taught to identify its various areas. On second day, Dr. Praful Singru, NISER Bhubaneswar exposed us to immunofluorescent tagging of proteins in brain tissue and visualising it by confocal microscopy. The electrophysiology component of lab session started with the learning of fabrication of different types of electrodes (tetrode and glass pipette) under the guidance of Dr. Kaveri Rajaraman, University of Hyderabad. The

tetrode, thus fabricated by participants were used for recording of local field potential and spike from antennal lobe of grasshopper. Dr. Joby Joseph showed the process of dissecting and exposing the grasshopper brain such that the animal remains alive during the whole experiment. We recorded and observed the signals picked up by the tetrode and learnt how to analyse them using spike sorting programme. The other lab session by Ms. Shilpi Singh (University of Hyderabad) demonstrated how to do extracellular local field potentials and intracellular membrane potential recording using glass electrodes. Later, participants were exposed to different instruments used in electrophysiological recordings, targeting neurons of a particular area, rupturing their membrane to facilitate entry of the electrode inside the cell and the details of obtaining the recordings. Also, participants learnt to observe the response of neurons to the odor stimulus. The last lab session was specially designed for teaching computer simulation and modeling of neurons and their network using Neuron and matlab programming. Dr. Suhita Nadkarni, IISER Pune explained the process of performing in-silico experiments on small synapses using Monte Carlo simulation. Dr. Rishikesh Narayanan, IISc Bangalore told about basics of dendritic computation.

All the sessions were marked by intense discussions between students and the faculty. To explore the research and scientific aptitude of participants, some tests were also given. In line with this, we were given the opportunity to critically evaluate a research paper and present it in the form of a poster. It was a great learning experience for all participants. Apart from this, few students including me were selected to present their work orally. There were group presentations of all the three groups. This session was monitored by Dr. KS Krishnan, NCBS Bangalore. At the end of workshop, group photography was done to keep school activities in mind.

In retrospect, I feel that the VII SERB School in Neuroscience provided me with an unparalleled opportunity to learn and understand electrophysiology and other techniques. This was a great occasion to

discuss my research with neuroscientists as well as students from across the country and abroad. I strongly feel that this school was useful for budding neuroscientists like me. I am very grateful to DST-SERB and CNCS, University of Hyderabad, who kindly agreed to sponsor and orga-

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