Plenary Lecture
Memorial Lectures

Plenary Lecture

(March 16, 14:00–15:00, Room A)

1SL04A

Life Science in Japan—Past 50 years and future

Mitsuhiro Yanagida(*Okinawa Institute of Science and Technology Graduate University*)

The Memorial Lecture for W.Trautwein

(March 16, 11:05–12:05, Room A)

1SL01A

Pluripotent Stem Cells: From Physiology to Regenerative Medicine

Hescheler, Juergen(*Institute of Neurophysiology, University of Cologne, Germany*)

Due to their ability to reproduce the embryonic differentiation of all cellular phenotypes, embryonic and induced pluripotent stem (ES, iPS) cells represent an ideal tool to study the physiology of embryogenesis under in vitro conditions as well as to provide a new source for cellular replacement therapy. We cultivated ES and iPS cells in three dimensional cell aggregates (embryoid bodies), where they differentiate into derivatives of all three germ layers. To select only one lineage, e.g. the cardiac lineage (cardiomyocytes, CMs), and to allow the identification of the transplanted cells, transgenic ES or iPS cells were used containing a vector with two cloning sites for enhanced green fluorescent protein (EGFP) and puromycin resistance for selection under the ?-MHC promoter. Based on the pioneering advances in cardiac electrophysiology provided during Prof. Trautwein's era this lecture will demonstrate how our knowledge on fundamental questions on CMs including rhythm, action potential generation and calcium channel regulation can be answered using such ES or iPS cell derived CMs. Second, in order to demonstrate the ability for regenerative medicine and tissue repair, CMs cells were injected into the cryoinfarcted left ventricular wall of adult wild type mice. Using a slicing technique of the heart the electrophysiological maturation of transplanted CMs will be demonstrated. Third, reprogramming of fibroblasts from patients with LQT3 or CPVT syndrome by ectopic expression of Oct4, Sox2, c-Myc and Klf4 resulted in generation of iPS cells for disease modeling. No COI.

Arimura Memorial Lecture

(March 17, 11:05–12:05, Room B)

2SL05B

Challenge to novel bioactive peptides

Kangawa Kenji(*National Cerebral and Cardiovascular Center Research Institute*)

Hagiwara Memorial Lecture

(March 16, 11:05–12:05, Room A)

1SL03F

Higher-order motor areas in the frontal cortex of primates

Tanji, Jun(*Brain Science Center, Tohoku University*)

Motor areas rostral to the primary motor cortex develop greatly in primates. It is generally agreed that at least five motor areas exist medially (SMA, pre-SMA, SEF, CMAr and CMAc), and three areas laterally (PMd, PMv, and FEF), constituting higher-order motor areas. First and foremost, it is very important to reconfirm anatomical foundations established as the basis for areal differentiation; each of the eight areas is characterized by distinct anatomical connectivity, both cortico-cortical and cortico-subcortical. Differences in afferent and efferent connectivity provide plausible explanations for area-unique lesion effects reported in animal studies and clinical signs observed among brain-damaged patients. Although all of these areas influence limb or oculomotor actions, roles in selecting muscles and in determining the magnitudes of muscle activity are much less significant than for the primary motor cortex. Conversely, premotor areas are more crucial in the selection of action based on sensory information and on behavioral-context. Electrical stimulation is by no means suitable for detecting functional roles played by each of higher-order motor areas; stimulus artifacts are totally remote from naturally-occurring behavior. It is now established that functional properties characterizing each area could be revealed only under behavioral conditions specifically calling for the preferential use of individual areas. Accumulation of analytical studies have begun to reveal "raison d'être" for each area. No COI.

Hagiwara Memorial Lecture

(March 17, 9:00–10:00, Room C)

2SL06C

Mechanisms of Hearing—studies from hair cells to the cortex—

Ohmori, Harunori(*Department of Physiology, Faculty of Medicine, Kyoto University*)

Professor Hagiwara made initiatives in various fields of neurobiology, and also in the field of audition using the lateral line organ hair cells of the mudpuppy (1975). In this Hagiwara memorial lecture, I will summarize three topics in the hearing researches conducted in my laboratory using the chick, since1982 after my 2 years stay in Hagi's laboratory. The first talk is on the hair cell transduction and transmission, which demonstrated that hair cell mechano-electrical transduction is conducted through gating of ion channels and that glutamate is released as the afferent neuro-transmitter from hair cells.

The second talk is about the brainstem auditory information processing, particularly the timing information. I will summarize distinctive tonotopic specializations in morphology and electrophysiology in the nucleus magnocellularis (NM) that extracts timing information from the auditory nerve fibers and in the nucleus laminaris (NL) that processes interaural time difference (ITD) by the coincidence of excitatory inputs from bilateral NM. Furthermore I will talk the roles of inhibition in the ITD processing in NL where the sound level dependent tonic inhibition and the phasic inhibition that follows ipsilateral NM spike co-operate to make the ITD processing tolerant to a wide range of sound level. The third talk is on a photometric patch electrode (PME) methodology, which uses a patch electrode as a light guide. The method is still developing and we are applying the PME to the end of exploring the neural activity in vivo by recording both electrical and optical signals simultaneously from deep brain tissues such as NM, the inferior colliculus and the Field-L (the avian auditory cortex). No COI.

Tawara Memorial Lecture

(March 18, 9:00–10:00, Room C)

Named after Tawara Memorial Lecture

(March 18, 11:05–12:05, Room D1)

3SL11C

Breathing and Emotion

Homma, Ikuo(*Tokyo Ariake Univ. of Medical and Health Sciences*)

Breathing is a basic physiological function. We inhale oxygen for energy metabolism and controlling carbon dioxide to maintain acid-base balance. However, besides metabolic breathing, we have behavioral breathing. Breathing can change in response to changes in various emotions. Therefore, final respiratory motor output, which we can see from the chest wall movements, is determined by complex interaction between metabolic and behavioral breathing. These factors are yielded in the brainstem and cortical structures. Descending spinal pathways for metabolic and behavioral breathing are different and studies showed the cortical projections to brainstem respiratory neurons, indicating that the behavioral influences arising from higher centers modify metabolic breathing pattern. Emotions exist as an innate mental and physical part of the body, but emotions are much more complex and subdivided into numerous dimensions. The limbic system is activated when there is a change in emotion and various changes occur in the body. The tight link between emotion and breathing was observed in our study on anxiety and respiration. In our experiment, we tested what we call "anticipatory anxiety" by connecting an electrode to subjects and telling them that in the next two minutes, an electric shock will be administered. During this time an increase in respiratory rate was observed. We also tested trait anxiety scores and found that there was a positive correlation between the trait anxiety score and increase in respiration rate. We also found that neural activation, which was synchronized with respiration, occurred in the amygdala examined by EEG dipole tracing method. The activities synchronized with respiration were also observed in the amygdala in the limbic-brainstem-spinal cord preparation of new born rat. I will review the relationship between emotion and respiration. No COI.

3SL12D1

Promotion of medical technology through integration of physiology and other fields

Kajiya, Fumihiko(*Kawasaki Univ Med Welf*)

The American Institute for Medical and Biological Engineering (AIMBE), a collaborative organization representing academia, industry and government, highlighted 28 medical technologies as the key innovations of the 20th century to their "Hall of Fame" in 2005 and subsequent years. In relation to Dr. Sunao Tawara's great discovery of the "Cardiac Conduction System", a better understanding of cardiac electrical function contributed to develop many essential medical devices such as electrocardiogram (ECG), cardiac defibrillator and the pacemaker with recent breakthroughs including Genomics in the Hall. Virtually, every person has benefitted from these key innovations in receiving better health care. These creative and innovative achievements have been made in most cases through close cooperation among "physiology", and other medical, scientific and engineering fields, since one of the fundamental paradigms in physiological research is integration. According to the "National Industrial Technology Strategy" report of Japan, the Medical Engineering Technology Industrial Strategy Consortium (METIS) was organized to foster the development of innovative medical technology in 2001. The scope of METIS includes not only medical devices but also a broad spectrum of science and engineering in medicine. Now we dream that mutual understanding and cooperation between physiology and other fields can develop medical technology further. From my experience in METIS as a co-chair for 10 years, I would like to emphasize the promotion of many possible contributions in the interdisciplinary fusion between physiology and other fields to further advance medical technologies. No COI.