

Proceedings of the 55th Meeting of Japan Society of Physiological Anthropology

President: Susumu Kudo

(Assistant Professor, Department of Mechanical Engineering, Shibaura Institute of Technology)

Date: June 17–18, 2006

Place: Toyosu Campus, Shibaura Institute of Technology

Special lecture Homeostasis of Circulatory System Maintained by Transferome

Kazuo TANISHITA

Department of System Design Engineering, Keio University

The function of living system is maintained by cardiovascular system, which consists of various scale of vascular network, from large vessels to micro-vessels. This multi-scale cardiovascular system contributes to supply and discard substances with wide range of molecular weight in the individual cell and tissue. Such an integrated system of blood flow and mass transfer is referred to as “transferome” in the living system. The state of homeostasis may be described by the transferome. To understand the function of living system, it is very important to have an integrated view of transferome instead of considering the localized phenomena. Unfortunately we have never developed the new field of transferome at present, but the definitely need the cross-disciplinary approach to have a integrated view for transferome. The cross-disciplinary approach of physiological anthropology effectively contributes to the development of new field such as the integrated view to the homeostasis.

S-1 Significance of Brain Activity Measurement by means of Animal Experiments

Hajime HARADA

Laboratory of Ergonomics, Department of Industrial Design, Tohoku Institute of Technology

Hippocampus which is in the limbic system is introduced as an example of brain activity measurement of the animal. Hippocampus has been known to reveal the mechanism of memory and epilepsy. The hippocampi of rabbits subjected to daily electrical stimulation has been used as the model of epilepsy so called “kindled hippocampus”.

Theta rhythm occurs in the hippocampi of rodents such as rats and rabbits when they are awake and are focussing on something. However, theta rhythm desynchronizes and EEG

spikes (interictal spikes) occur in the kindled hippocampus. Interictal spikes are found to be inhibitory EEG spikes and they serve as a protective mechanism against seizure in the kindled hippocampi. Long-term potentiation has been considered as one of the candidates for the memory mechanism and are also observed in slices from human hippocampi removed from the epilepsy patient. Human hippocampal neurons in vitro show similar activities to the rodent cells.

Brain activities obtained from the animal experiments are chosen as variables to explain the mechanism of brain function of humans. In the field of physiological anthropology, in order to understand the mechanism of brain functions such as emotion, consciousness and mind, the process of brain evolution is an important factor. It would be essential to explain the mechanism of responses obtained from human subjects together with the results of animal experiments.

S-2 Observing Brain Activity through Neuromagnetic Brain Responses

Kentaro KOTANI

Faculty of Engineering, Kansai University.

Magnetoencephalography (MEG) is a method to measure neuromagnetic activities generated by the excitement of neurons in the brain. The method has been developed as a non-invasive technique for imaging brain functions. This presentation introduces general characteristics of MEGs comparing with other imaging techniques such as functional Magnetic Resonance Imaging (fMRI) and Position Emission Tomography (PET), and two joint studies in our laboratory with two other institutes using 122 ch whole-head neuromagnetometer: (1) Visualization of recovery processes from hemiplegia using mirror therapy using movement related brain fields and (2) MEG measurement from dyslexic children while performing oral reading. The first study measures MEGs during performing rehabilitation therapies including mirror

therapy to explore the effective rehabilitation scheme in terms of neurophysiology. The second study focuses on inferior temporal gyrus posterior, where distinguishing activities can be observed between control and dyslexic children performing recitation. As a conclusion, strength and limitations of the MEGs for observing brain activity were discussed along with the field of physiological anthropology.

S-3 Neural Substrates Underlying Different Emotions using fMRI

Jin-Hun Sohn

Dept. of Psychology, The Brain Research Institute, Chungnam National University

The presentation describes what would be benefit of using fMRI for the study of physiological anthropology field, and the main findings from the studies of emotion and cognition using fMRI in my lab. Specifically the following topics will be addressed:

- 1) How does fMRI work?
- 2) Identification of the neural substrates associated with basic emotions (joy, sadness, anger, disgust, fear etc.).
- 3) Identification of the effect of exposure of the forest landscape on human sensibility.
- 4) Application of fMRI for emotion and cognition researches.

In conclusion, brain mapping method with fMRI would be a very useful and strong research method in the field of physiological anthropology, especially for affect and cognition which are mainly genetically determined. The researches done in my lab showed that different neural substrates are involved among different emotions. Between positive emotions (i.e., joy and humor), the function of same brain areas associated with both positive emotions turned out different and the involvement of neural areas in between them was different.

S-4 Significance and Problems of Brain Activity Measurements by using fMRI and MEG

Yoshiaki KIKUCHI

Tokyo Metropolitan University Graduate School of Human Health Science

Recently, the non-invasive brain measurements such as fMRI (functional magnetic resonance imaging), MEG (magnetoencephalography) and NIRS (near-infrared spectroscopy) have been developed and available in a variety of research fields. Among them, the brain regions could be well estimated by using fMRI and MEG which have relative advantage of respectively high spatial resolution and high temporal resolution. By using MEG, we have succeeded in carrying out multi-dipole estimation, with specifically high temporal resolution of 3.6 msec in average, of multiple brain activity related to auditory discrimination. However, the time range covering the brain activity is limited up to 1 sec. In contrast, fMRI including its event-related techniques has a comparatively low temporal resolution (>1000 msec) as compared to MEG. However, it can cover wider time range

(several 10 sec or 1 min), then is effective in wide research fields on usual cognitive and emotional states, compared to MEG. Therefore, we should use or combine these techniques by understanding their characteristics and by constructing the brain model to be clarified.

1-1 Interaction with SNP Allele in Multiple Loci Contributes to Human Skin Color Diversity (1)

Sumiko ANNO¹⁾, Takashi ABE²⁾, Koichi SAIRYO³⁾, Susumu KUDO¹⁾, Takuji YAMAMOTO⁴⁾, Koretsugu OGATA⁴⁾ and Vijay K. GOEL⁵⁾

1) School of Engineering, Shibaura Institute of Technology, 2) The laboratory for Research & Development of Biological Databases, National Institute of Genetics, 3) Faculty of Medicine, The University of Tokushima, 4) Shimadzu Biotech, Shimadzu Corporation, 5) Department of Bioengineering, College of Engineering, University of Toledo

Our study aims to clarify molecular basis of human skin color diversity and investigate environmental adaptability to ultraviolet irradiation in order to predict human health risk influenced by severe environments in the future. Samples obtained from 122 Caucasians living in Toledo, Ohio were used for DNA extraction. DNA was used for SNP genotyping with the technology of Masscode™ system that involves the two-step PCR amplification and comprises a platform chemistry of cleavable mass spectrometry tags. The results of the SNP genotyping show that SNP allele in multiple loci are related and suggest high possibility of linkage disequilibrium. Our study plans to collect data on other ethnic groups in order to analyze correlation between SNP allele in multiple loci and identify loci associated with human skin color diversity. Our final goal is to clarify interactions between atmospheric environments using remote sensing data and SNP allele frequency.

1-2 Diurnal Rhythm of the Lipid Metabolism in Rats

Shigeru SAEKI¹⁾, Yoshimi SOMEYA¹⁾, Azumi YAMAGISHI^{1,2)}, Cheol-Min KIM¹⁾, Akemi Hosoda¹⁾, Tomoe OGINO¹⁾, Dong-Ho KIM¹⁾ and Yoshiaki SONE¹⁾

1) School of Human Life Science, Osaka City University, 2) Faculty of Education, Art and Science, Yamagata University

The present study was undertaken to examine the diurnal rhythm of lipid metabolism in rats. Although the plasma and hepatic cholesterol concentrations in the dark period were similar to those in the light period, the hepatic mRNA expression of HMG-CoA reductase, the rate-limiting enzyme of cholesterol biosynthesis, was significantly higher in the dark period than in the light period. The hepatic mRNA expression of cholesterol 7 α -hydroxylase, the rate-limiting enzyme of bile acids biosynthesis, was also significantly higher in the dark period than in the light period. Changes in the hepatic mRNA expressions of nuclear receptors, liver X receptor (LXR) and farnesoid X receptor (FXR), which are transcriptional factors of cholesterol metabolism, were consistent with those in the hepatic HMG-CoA reductase and cholesterol 7 α -hydroxylase