

ISOTT2014 で採択された演題名

- ① Effects of cosmetic therapy on cognitive function of elderly women: A time-resolved spectroscopy study
- ② Effects of acupuncture on anxiety levels and prefrontal cortex activity measured by near-infrared spectroscopy: a pilot study
- ③ Effects of aging on working memory performance and prefrontal cortex activity: A time-resolved spectroscopy study
- ④ Gender and Age Analyses of NIRS/STAI Pearson Correlation Coefficients at Resting State
- ⑤ Effect of the antioxidant supplement Pyrroloquinoline quinone disodium salt (BioPQQ™) on cognitive functions
- ⑥ Detection of ROSC in patients with cardiac arrest during chest compression using NIRS: A pilot study

抄録①

**Effects of cosmetic therapy on cognitive function of elderly women:**

**A time-resolved spectroscopy study**

K. Sakatani a, A. Machida b; M. Shirato b; C. Kanemaru c, S. Nagaic

a Department of Electrical and Electronics Engineering, College of Engineering, and Department of Neurological Surgery, School of Medicine, Nihon University, Japan

b SHISEIDO Research Center, Japan

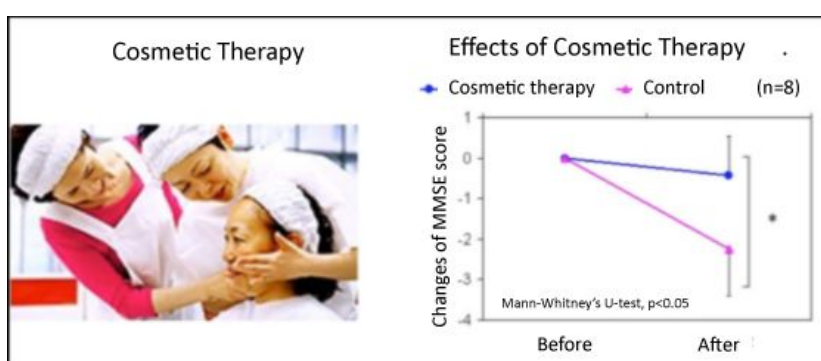
c SHISEIDO Beauty Creation Research Center, Japan

email address; sakatani.kaoru@nihon-u.ac.jp

With the rapid increase in dementia in developed countries, it is important to establish methods for maintaining or improving cognitive function in elderly people. To resolve such problem, we have been developing a cosmetic therapy (CT) program for elderly women, which consists of deep breathing using fragrances and relaxing light exercise, followed by skin care and make-up. We recently found that the elderly women who participated in the CT program for a period of three months exhibited greater scores of Mini-Mental State Examination (MMSE) than the controls (Fig. 1). However, the mechanism and limitation of CT have yet to be elucidated. In order to clarify these issues, by employing time-resolved spectroscopy (TRS), we evaluated the effect of CT on prefrontal cortex (PFC) activity in elderly females ( $82.2 \pm 6.3$  years) with various levels of cognitive impairment. Based on the MMSE score, the subjects were classified into a mild (means MMSE score,  $24.1 \pm 3.8$ ) and moderate ( $10.3 \pm 5.8$ )

cognitive impairment (CI) group ( $p < 0.0001$ ). The mild CI group exhibited significantly larger baseline concentrations of oxy-Hb and t-Hb than the moderate CI group. CT significantly increased the baseline concentrations of oxy-Hb ( $p < 0.002$ ) and t-Hb ( $p < 0.0013$ ) in the left PFC in the mild CI group. In contrast, CT did not change the concentrations of oxy-Hb and t-Hb in the moderate CI group ( $p > 0.05$ ). These results suggest that CT could affect cognitive function by alternating PFC activity in elderly women. It should be noted, however, that although CT may be effective for mild CI, it may not be effective for moderated CI.

Fig. 1



抄録②

### Effects of acupuncture on anxiety levels and prefrontal cortex activity measured by near infrared spectroscopy: a pilot study

K. Sakatani a, b, M. Fujii c, N. Takemura a

a Department of Electrical and Electronics Engineering, College of Engineering, and

b Department of Neurological Surgery, School of Medicine, Nihon University, Japan

c Yui Acupuncture Clinic, Japan

email address; sakatani.kaoru@nihon-u.ac.jp

There is increasing evidence that acupuncture is useful in treating somatic and psychological disorders caused by stress; however, the physiological basis of these effects remains unclear. Recently, we found that acupuncture modulated the autonomic nervous system (ANS) by decreasing sympathetic nervous function and increasing parasympathetic function, which could cause relaxation of stress responses. Interestingly, acupuncture modulated prefrontal cortex (PFC) activity measured by near infrared spectroscopy (NIRS); however, PFC activity induced by acupuncture was not closely linked with ANS function [1]. In the present study, we evaluated the effect of acupuncture on psychological conditions (i.e., anxiety) and PFC activity. We

studied 10 patients with anxiety disorders and measured anxiety levels by State-Trait Anxiety Inventory (STAI), including state anxiety (STAI-1) and trait anxiety (STAI-2). Employing a two-channel NIRS, we measured oxy-Hb concentration in bilateral PFC at rest, and evaluated the asymmetry of the PFC activity by calculating the Laterality Index at Rest (LIR) [2]; positive LIR (Rt>Lt) was associated with a higher anxiety level while negative LIR (Rt<Lt) was related to a lower anxiety level. The patients were treated by acupuncture (WHO-GV23, GV20, and BL7 for 15 min) at Yui Clinic. The treatment significantly decreased the STAI-1 score from  $50.8 \pm 9.04$  to  $41.0 \pm 10.1$  ( $p < 0.001$ ); but not the STAI-2 score ( $p > 0.05$ ). The NIRS measurements indicated the presence of spontaneous oscillations of oxy-Hb in the bilateral PFC at rest before and after the treatment. Notably LIR decreased from  $-0.0319 \pm 0.139$  to  $-0.159 \pm 0.0937$  in 7 out of the 10 subjects ( $p < 0.01$ ), while 3 subjects showed an increasing tendency. The present pilot study indicates that acupuncture is effective in decreasing anxiety levels in patients with anxiety disorders. Our NIRS data suggested that acupuncture altered the balance of PFC activity at rest in the patients, resulting in the relaxation effects.

#### References

1. Sakatani K, et al. Adv Exp Med Biol. 2010;662:455-60.
2. Ishikawa W, et al. J Biomed Opt. 2014;19(2):27005

#### 抄録③

### **Effects of aging on working memory performance and prefrontal cortex activity: A time-resolved spectroscopy study**

J. Shi<sup>1</sup>, Y. Wang<sup>1</sup>, J. Wang<sup>1</sup>, T.C. Geng<sup>1</sup>, H. Zuo<sup>2</sup>, M. Tanida<sup>3</sup>, K. Sakatani<sup>4</sup>

<sup>1</sup> Dept of Neurology, <sup>2</sup> Dept of Neurosurgery, Yuquan Hospital, Tsinghua University School of Medicine, China

<sup>3</sup> Shiseido Research Center, Japan

<sup>4</sup> NEWCAT research institute, Nihon University College of Engineering, Japan

email address; email address; shijie0000@163.com

We employed time-resolved spectroscopy (TRS) to measure the prefrontal cortex (PFC) activity, while younger and older subjects performed a working memory (WM) task. 10 healthy younger and 10 healthy older subjects were recruited for this study. All subjects performed a Sternberg's item-recognition task in which the memory-set size varied between 1 and 6 digits. Employing TRS-20 (Hamamatsu Photonics), we measured

cerebral blood oxygenation changes in PFC activity during the task. In order to determine left/right asymmetry of PFC activity during the working memory task, we calculated the right laterality score of  $\Delta\text{oxy-Hb}$  ( $\text{right}\Delta\text{oxy-Hb} - \text{left}\Delta\text{oxy-Hb}$ ; positive values indicate greater activity of the right PFC, while negative values indicate greater activity of the left PFC [1]. During Sternberg's task, tests for difference between younger group and older group in accuracy for low memory-load and high memory-load were not significant. However in high memory-load tasks older subjects performed slower than younger subjects ( $P < 0.05$ ). We found that younger group showed right lateral responses with a stronger right than left activation in the frontal pole, whereas older group showed bilateral-responses ( $P < 0.05$ ). The present results obtained by TRS are consistent with the HAROLD model; working memory tasks cause asymmetrical PFC activation in younger adults, while older adults tended to reduce hemispheric lateralization [2].

#### References

1. K. Sakatani, et al: Adv Exp Med Biol. 2014 (in press)
2. R. Cabeza: Psychol Aging 17: 85-100 (2002)

#### 抄録④

#### **Gender and Age Analyses of NIRS/STAI Pearson Correlation Coefficients at Resting State**

T. Matsumoto<sup>a</sup>, Y. Fuchita<sup>a</sup>, K. Ichikawa<sup>a</sup>, Y. Fukuda<sup>a</sup>, N. Takemoto<sup>b</sup> and K. Sakatani<sup>b</sup>  
<sup>a</sup> Graduate School of Advanced Science and Engineering, Waseda University, Japan  
<sup>b</sup> Institute/Department, University, Country  
email address: takashi@matsumoto.elec.waseda.ac.jp

According to the valence asymmetry hypothesis, the left/right asymmetry of prefrontal cortex (PFC) activity is correlated with specific emotional responses to mental stress and personality traits [1].

In a previous study [2] we studied the relation between emotional state and asymmetry in PFC activity at rest by using near-infrared spectroscopy (NIRS). We measured spontaneous oscillation of oxyhemoglobin (oxy-Hb) concentrations in the bilateral PFC at rest in normal adults employing two-channel portable NIRS. In order to analyze left/right asymmetry of PFC activity at rest, we calculated the laterality index at rest (LIR).

We investigated the Pearson correlation coefficient between the LIR and anxiety levels evaluated by the State-Trait Anxiety Inventory (STAI) test.

We found that the right PFC was more active at rest than the left PFC, corresponding to a higher anxiety level measured by the STAI. Namely, subjects with right-dominant activity at rest showed higher STAI scores, while those with left dominant oxy-Hb changes at rest showed lower STAI scores such that the Pearson correlation coefficient between LIR and STAI was positive.

Since the number of data was limited (39) in [2], a method is called for to “robustify” the analysis for the positive correlation. The Bootstrap method [3] is one of the means to handle such data by drawing samples with replacement. By generating 10000 bootstrap samples, this study performed statistical tests on the data and reports the following:

(i) Lower and upper confidence bounds of the 0.05 confidence interval for the LIR/STAI Pearson correlation coefficient were 0.177 and 0.738 with mean value 0.4925 so that the target correlation coefficient can be considered positive at least within the statistical analysis.

(ii) The Pearson correlation coefficient between LIR and STAI does not appear to depend on ages within the present framework.

(iii) The Pearson correlation coefficient between LIR and STAI for male is statistically different from that for female within the proposed statistical method.

Since the employed equipment weighs only 100 g and is portable, the proposed quantity LIR could be used as a simple method for evaluating individual's stress values in practical situations.

[1] R. J. Davidson, “Affective style and affective disorders: perspectives from affective neuroscience,” *Cognit. Emotion* 12(3), 307-330 (1998).

[2] W. Ishikawa, M. Sato, Y. Fukuda, T. Matsumoto, N. Takemura, K. Sakatani, “Correlation between asymmetry of spontaneous oscillation of hemodynamic changes in the prefrontal cortex and anxiety levels: a near-infrared spectroscopy study” *J. Biomed. Opt.* 19(2), 027005 (Feb 18, 2014).

[3] B. Efron. Bootstrap methods: Another look at the jackknife. *The Annals of Statistics*, 7(1):1-26, 1979.

抄録⑤

**Effect of antioxidant supplements, Pyrroloquinoline quinone disodium salt (BioPQQ™), on cognitive functions**

Y. Itoha, K. Hinea, T. Miuraa, T. Uetakeb, M. Nakanoc

N. Takemurad, and K. Sakatanid, e

a Department of Psychology, Faculty of Letters, Keio University, Japan

b CX Medical Japan Co., Inc., Japan

c Niigata Research Laboratory, Mitsubishi Gas Chemical Co., Inc., Japan

d Department of Electrical and Electronics Engineering, College of Engineering, Nihon University, Japan

e Department of Neurological Surgery, Nihon University School of Medicine, Japan  
email address: masahiko-nakano@mgc.co.jp

A placebo-controlled, double-blinded study to examine the effect of pyrroloquinoline quinone (PQQ) disodium salt (BioPQQ™) on cognitive functions was conducted with the healthy participant of 41 subjects between 50 to 70 years old. Subjects were orally given 20mg of BioPQQ™ per day or placebo for 12-week. As for cognitive functions, selective attention by Stroop and reverse Stroop test, and visual-spatial cognitive function by the lap top tablet Touch M were evaluated. In Stroop test, when the one outlier was omitted, the analysis showed that the change of small stroop interference ratios (Sis) for the PQQ group was significantly smaller than for the placebo group ( $p < 0.05$ ). In the stratification analyses dividing each group into two groups at the threshold of initial score 70 points showed that only in PQQ group with the score of the lower group (initial score  $< 70$ ) significantly increased ( $p = 0.002$ ). With no abnormal blood and urinary adverse events, and no adverse internal and physical examinations all through the study, no safety concerns were identified under the administration conditions of the study. The preliminary experiment showed that the blood flow in the brain increased detected by NIRS test. The results indicate that PQQ is suggested to improve brain functions in aged persons especially in attention and working memory.

抄録⑥

**Detection of ROSC in patients with cardiac arrest during chest compression using NIRS:  
A pilot study**

T. Yagiab, K. Nagaoa, T. Sogaab, T. Kawamoritab, M. Ishiib, N. Chibab, K. Watanabeab,  
A. Yoshinoc, K. Sakatani d

a Dept of Cardiology, Cardiopulmonary Resuscitation and Emergency Cardiovascular Care,  
Surugadai Nihon University Hospital, Japan

b Dept of Emergency and Critical Care Medicine, Surugadai Nihon University Hospital,  
Japan

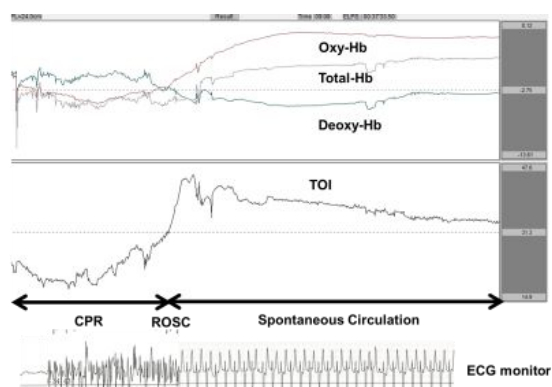
c Div. of Neurosurgery, Dept of Neurological Surgery, Nihon University School of Medicine, Japan

d NEWCAT Institute, Nihon University College of Engineering, Japan

email address: ygt0108@gmail.com

Return of spontaneous circulation (ROSC) during chest compression is generally detected by arterial pulse palpation and end-tidal CO<sub>2</sub> monitoring; however, it is necessary to stop chest compression during pulse palpation, and to intubate for monitoring end-tidal CO<sub>2</sub>. In the present study, we evaluated whether NIRS allows the detection of ROSC during chest compression without interruption. We monitored cerebral blood oxygenation in 16 patients with cardiac arrest [age 58.2±14.2, 15 male, 1 female] using NIRS (NIRX-200NX, Hamamatsu Photonics, Japan). On arrival at the ER, the attending physicians immediately assessed whether a patient was eligible for this study after conventional ALS and employed NIRS to measure CBO in the bilateral frontal lobe in patients. We found cerebral blood flow waveform in synchrony with chest compressions in all patients. In addition, we observed abrupt increases of oxy-hemoglobin concentration and tissue oxygen index (TOI), which were associated with ROSC detected by pulse palpation [Fig.1]. The present study suggests that NIRS may reliably assess the quality of chest compression in patients with cardiac arrest demonstrated by synchronous waveforms during cardiopulmonary resuscitation (CPR), which is consistent with a recent study [1]. Furthermore, NIRS may allow the detection of ROSC without interruption of chest compression and without intubation.

Fig. 1



Reference;

1. Koyama Y, Wada T, Lohman BD, et al : A new method to detect cerebral blood flow waveform in synchrony with chest compression by near-infrared spectroscopy during CPR. *Am J Emerg Med.* 2013;31:1504-8.