Traffic accidents caused by drowsiness have become a large social problem. In this study, we aimed to develop a drowsiness detection system by heart rate variability. Five subjects partipated in this study. Silent experimental room made them drowsy. The electrocardiogram, the electroencephalogram and the pulse wave measured as a physiology index. The sampling frequency was 2000 Hz. Video pictures of subjects were took to monitor their body motion. Simultaneously, Visual Analog Scale (VAS) was used as a subjective assessment. The R-R intervals were calculated from electrocardiograms to evaluate the relationship between drowsiness and the R-R interval. When a subject became drowsy, 0.1 Hz fluctuation in R-R interval was observed. As fluctuation variability increased, a subject felt more sleepy. It showed that heart rate fluctuation could detect drowsiness.

1-8 The Effect of Bathwater Additive on Arousal Level

Noriko MATSUURA[1),2)], Masami TACHIKAWA[3)], Taichi ISHIZAWA[4)], Shingo YANO[4)], Naoyuki SUZUKI[5)], Naomi ADACHI[2),6)], Ryoji ARITOMI[2)] and Shuichiro SHIRAKAWA[7)]

1) Research Institute on Sleep and Society, LOFTY, 2) S & A Associates, Inc., 3) Marketing Department, Tsumura Lifescience Co., Ltd., 4) Products Development Department, Tsumura Lifescience Co., Ltd., 5) Human Sensing Co., Ltd., 6) LOFTY Co., Ltd., 7) National Institute of Mental Health, National Center of Neurology and Psychiatry

Our study aims to investigate the effect of bathwater additive on arousal level after bath. Healthy university/graduate students (n=8) participated to the experiment in laboratory for three days. Participants bathed for 5min from CT15. We set three bathing conditions; bathe 1) without additive, 2) with an additive having aroma of citrus (NBC-KP-Yuzu), 3) with an additive having aroma of forests (NBC-KP-Shinryoku). Aromatic bathwater additives which dissolve and diffuse quickly (Tsumura Lifescience Co., Ltd.) were used. Twenty-minutes testing sessions were held at CT14.5, immediately after bath and 30 min after. Subjective sleepiness (KSS) and condition (VAS), Psychomotor Vigilance Task (PVT) and HRV by ECG were measured. Heart sympathetic nerve activity index (LF/HF in HRV) ($p<.05$), correct level of PVT ($p<.05$) and alertness ($p<.001$) with conditions 2&3 were significantly indicated. Results showed that bath with the additives having aroma which dissolve and diffuse quickly prevent decrease of arousal level and keep one active mentally and physically after bath.

1-9 Physiological Effects of Shinrin-yoku (4) A Case Study in Tsurui Village, Hokkaido

Hideki ISHII[1)], Bum-Jin PARK[2)], Takahide KAGAWA[3)] and Yoshifumi MIYAZAKI[2)]

1) Graduate School of Frontier Science, The University of Tokyo, 2) Center for Environment, Health and Field Sciences, Chiba University, 3) Forestry and Forest Products Research Institute

This study examined the physiological effects of Shinrin-yoku (taking in the atmosphere of the forest) in an oak forest in Tsurui village by investigating blood pressure, pulse rate, heart rate variability (HRV), and salivary cortisol concentration. Subjects were 12 male university students aged 20–23 (mean±SD: 21.2±0.9). On the first day, six subjects went to forest area, and the others went to a city area as a control. On the second day, subjects went to the opposite areas for cross check. In the morning, they sat on chairs watching the landscapes of each area for 15 minutes. As a result, 1) pulse rate was significantly lower, 2) the HF component of HRV was significantly higher, and 3) salivary cortisol concentration was significantly lower in the forest area compared to the city area. These responses suggest that sympathetic nervous activity was suppressed and parasympathetic nervous activity was enhanced indicating that Shinrin-yoku is an effective form of relaxation.

1-10 Physiological Effects of Shinrin-yoku (Taking in the Atmosphere of the Forest) (5) Results of Field Tests at 24 Sites throughout Japan

Bum-Jin PARK[1)], Yuko TSUNETSUGU[2)], Takeshi MORIKAWA[2)], Hideki ISHII[3)], Suguru FURUHASHI[4)], Hideki HIRANO[5)], Takahide KAGAWA[2)] and Yoshifumi MIYAZAKI[1)]

1) Center for Environment, Health and Field Sciences, Chiba University, 2) Forestry and Forest Products Research Institute, 3) Graduate School of Tokyo University, 4) Graduate School of Hokkaido University, 5) Forestry Agency of Japan

The purpose of this study was to examine the physiological effects of Shinrin-yoku (taking in the atmosphere of the forest). We conducted physiological experiments at 24 areas in 2005 and 2006. Twelve subjects for each experiment (288 subjects in total, 21.7±1.5 years old) walked in and watched the landscapes of forest and city areas to compare their relaxation effects. On the first day of each experiment, one group of 6 subjects was sent to a forest area, and the other group of 6 subjects to a city area. On the second day of each experiment, each group was sent to the opposite area for a cross-check. Heart rate variability (HRV), salivary cortisol concentration, blood pressure, and pulse rate were used as physiological indices. The results of the experiments show that walking and watching in forest areas lead to more active parasympathetic nervous activity, lower sympathetic nervous activity, lower concentrations of cortisol, lower systolic blood pressure, lower diastolic blood pressure, and lower pulse rate than those in city areas. These physiological measurements suggest that Shinrin-yoku has the capacity to relax the human body effectively.

1-11 Effects of Light Reflection Properties of Wood on Physiological Responses

Yeon-Kyu KIM[1)], Ryuichi UCHIGAWA[2)], Kaname HANAMURE[3)], Toshikazu TANAKA[4)], Kazuyuki ANEKAWA[4)], Noboru FUJIMOTO[5)] and Shigeki WATANUKI[6)]