



Academic Presentation at Neuroscience 2023 in the United States - Confirmation of Gamma Wave Synchronization in the Human Brain through Auditory Stimulation-

OSAKA, Japan, February 2, 2024 - Shionogi & Co., Ltd. (Head Office: Osaka, Japan; Chief Executive Officer: Isao Teshirogi, Ph.D.; hereafter "Shionogi") announced that Pixie Dust Technologies, Inc. (Head Office: Tokyo, Japan, Representative Directors: Yoichi Ochiai and Taiichiro Murakami; hereafter "PxDT") presented the findings of a research study at the academic presentation hosted by the Society for Neuroscience (SfN) during Neuroscience 2023¹.

Neuroscience 2023 is one of the world's largest academic conferences on neuroscientific research. The presented research is a collaborative effort between Shionogi, PxDT, which has previously signed a basic agreement for joint research on "Brain Activation and Cognitive Function Improvement through Auditory Stimulation,"² and the National Institute of Advanced Industrial Science and Technology (AIST; Head Office, Tokyo, Japan; President: Kazuhiko Ishimura).

Previous studies have reported a decrease in gamma waves in patients with cognitive impairment³. Moreover, the presentation highlighted the potential benefits of synchronizing gamma waves in the brain through the presentation of 40Hz sensory stimuli (auditory or visual) for inhibiting cognitive decline and brain volume reduction^{4,5}. However, the 40Hz sound used in previous studies was a monotonous pulse sound, making it challenging to incorporate into daily life.

In the current study, subjects exposed to specifically processed auditory stimuli, particularly 40Hz amplitude-modulated sounds, demonstrated statistically significant stronger synchronization of gamma waves compared to a control group exposed to non-modulated 40Hz low-frequency sounds. This result, demonstrating gamma wave synchronization with amplitude-modulated sounds that include sound information, suggests the potential for selecting modulated sounds, such as television or music, irrespective of the source, for the purpose of gamma wave synchronization. In the future, 40Hz amplitude-modulated sound may be useful in clinical application for dementia prevention in daily life.

Based on a shared concept of "Cognitive Function Care Integrated into Daily Life," Shionogi and PxDT are jointly developing "Gamma Wave Sounds" with the possibility of contributing to cognitive function care. While both companies continue to build further evidence for "Brain Activation and Cognitive Function Improvement through Auditory Stimulation," they remain committed to providing new solutions to address challenges faced by patients and society, focusing on dementia prevention and cognitive function improvement in daily life.

【About Gamma Wave Sounds】

Shionogi and PxDT are collaborating on research aimed at developing a new service that focuses on changes in brain rhythm activity due to sensory stimulation. The jointly developed "Gamma Wave Sounds" aims to modulate everyday sounds, such as those from television and radio, in real-time at 40Hz, enabling cognitive function care while living daily life.

References

1. Y. Nagatani, K. Takazawa, K. Maeda, A. Kambara, Y. Soeta, and K. Ogawa, "Phase lock of gamma wave by aurally presenting tones amplitude-modulated at 40 Hz," Neuroscience 2023 Abstracts, PST388.26/C44 (2023).
2. [Press release on June 21, 2022](#)
Conclusion of a basic agreement between Pixie Dust Technologies and Shionogi for joint research for improvement of cognitive function and brain activation by sound stimulation
~ With the vision of offering continual care for dementia patient in everyday life~
3. C. S.Herrmann, and T. Demiralp. "Human EEG gamma oscillations in neuropsychiatric disorders," Clinical Neurophysiology 116, 2719–2733 (2005).
4. A. J. Martorell et al., "Multi-sensory Gamma Stimulation Ameliorates Alzheimer's-Associated Pathology and Improves Cognition," Cell 177, 256-271.e22 (2019).
5. D. Chan et al., "Gamma frequency sensory stimulation in mild probable Alzheimer's dementia patients: Results of feasibility and pilot studies," PLOS ONE 17, e0278412 (2022).

Forward-Looking Statements

This announcement contains forward-looking statements. These statements are based on expectations in light of the information currently available, assumptions that are subject to risks and uncertainties which could cause actual results to differ materially from these statements. Risks and uncertainties include general domestic and international economic conditions such as general industry and market conditions, and changes of interest rate and currency exchange rate. These risks and uncertainties particularly apply with respect to product-related forward-looking statements. Product risks and uncertainties include, but are not limited to, completion and discontinuation of clinical trials; obtaining regulatory approvals; claims and concerns about product safety and efficacy; technological advances; adverse outcome of important litigation; domestic and foreign healthcare reforms and changes of laws and regulations. Also for existing products, there are manufacturing and marketing risks, which include, but are not limited to, inability to build production capacity to meet demand, lack of availability of raw materials and entry of competitive products. The company disclaims any intention or obligation to update or revise any forward-looking statements whether as a result of new information, future events or otherwise.

For Further Information, Contact:

SHIONOGI Website Inquiry Form : <https://www.shionogi.com/global/en/contact.html>