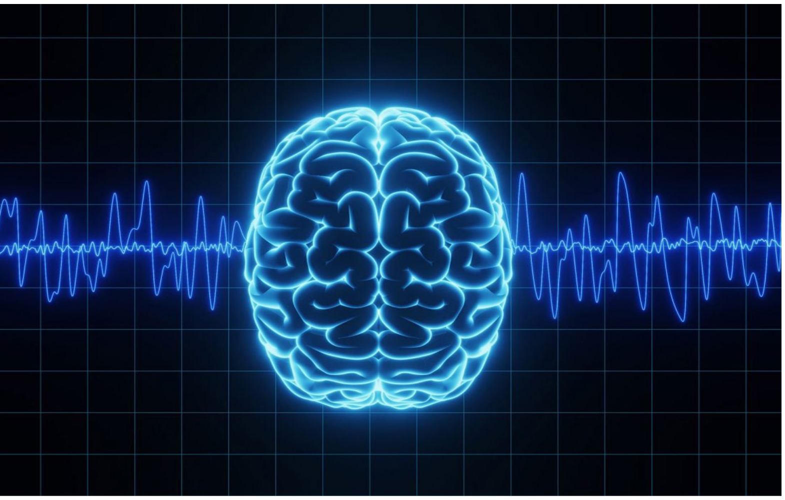
In The News

Century-old brain wave mystery solved

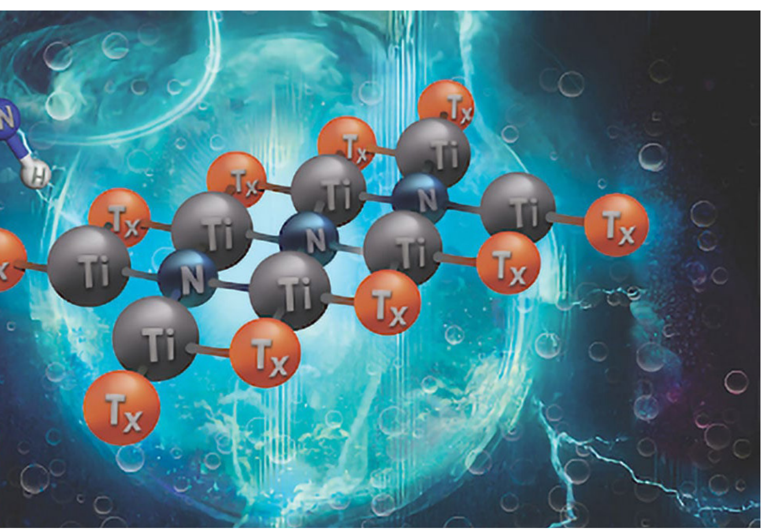
For over a century, scientists have observed rhythmic waves of synchronized brain activity, but their origins remained unclear. Researchers at Yale University have now pinpointed where gamma waves arise and linked



them directly to behavior. Using a new technique called CBASS (Clustering Band-limited Activity by State and Spectrotemporal feature), Jessica Cardin, PhD, and her team achieved unprecedented precision in mapping gamma activity. Unlike the once-assumed continuous oscillations, gamma waves occur in short, intermittent bursts. By recording neuronal activity at 16 sites in the visual cortex, the re-searchers discovered that gamma activity emerges through dynamic interaction between the thalamus and cortex, rather than being generated solely in one region. Disrupting tha-lamic input impaired gamma activity and mice's ability to perform a visual task, while arti-ficially inducing gamma signals tricked mice into perceiving a stimulus. These findings re-veal that gamma waves integrate sensory information to guide behavior. Since gamma ac-tivity is altered in disorders like schizophrenia and Alzheimer's, Cardin's lab now aims to explore whether gamma patterns could serve as early biomarkers for neurodegenerative disease detection and monitoring. ◆

Wonder material for renewable energy

Scientists developing cleaner technologies are exploring two-dimensional materials that could revolutionize renewable energy systems. Research published in the *Journal of the American Chemical Society* focuses



on MXenes, a promising class of low-dimensional compounds capable of catalyzing the conversion of atmospheric elements into ammonia, a crucial ingredient in fertilizers. This process could make ammonia production cleaner and more energy-efficient. Study challenges the long-held view that catalytic performance depends solely on the type of transition metal used. Instead, the researchers found that structural and chemical factors play critical roles. By replacing carbon atoms with nitro-gen, they can adjust MXenes' vibrational properties, tailoring them for specific renewable energy applications. Yoo notes that nitride MXenes show improved catalytic performance compared to their carbide counterparts, offering efficient and cost-effective alternatives. Using Raman spectroscopy and computational modeling, the team analyzed how MXenes interact with solvents during electrochemical ammonia synthesis. Djire emphasizes that understanding how atomic structures influence catalysis could lead to sustainable pro-duction of essential chemicals and fuels from abundant natural resources. ◆