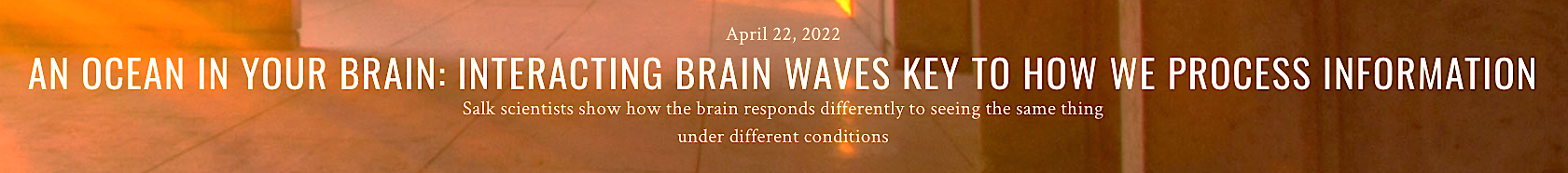
****

by Salk Institute APRIL 22, 2022

For years, the brain has been thought of as a biological computer that processes information through traditional circuits, whereby data zips straight from one cell to another. While that model is still accurate, a new study led by Salk Professor Thomas Albright and Staff Scientist Sergei Gepshtein shows that there's also a second, very different way that the brain parses information: through the interactions of waves of neural activity. The findings, published in Science Advances on April 22, 2022, help researchers better understand how the brain processes information.

"We now have a new understanding of how the computational machinery of the brain is working," says Albright. "The model helps explain how *the brain's underlying state* can change, affecting people's attention, focus, or ability to process information."

Gepshtein likens the new understanding to wave-particle duality in physics and chemistry—the idea that light and matter have properties of both particles and waves. In some situations, light behaves as if it is a particle (also known as a photon). In other situations, it behaves as if it is a wave. Particles are confined to a specific location, and waves are distributed across many locations. Both views of light are needed to explain its complex behavior.

Rather than a flash of light activating specialized sensory cells, the researchers showed how it creates distributed patterns: waves of activity across many neighboring cells, with alternating peaks and troughs of activation—like ocean waves.

"The traditional view of brain function describes brain activity as an interaction of neurons. Since every neuron is confined to a specific location, this view is akin to the description of light as a particle," says Gepshtein. "We've found that in some situations, brain activity is better described as interaction of waves, which is similar to the description of light as a wave. Both views are needed for understanding the brain."

The researchers hypothesize that the same kinds of waves are being generated—and interacting with each other—in every part of the brain's cortex.Waves generated by the brain itself, by subtle cues in the environment or internal moods, can change the waves generated by sensory inputs. The discovery of how neural waves interact is far-reaching.