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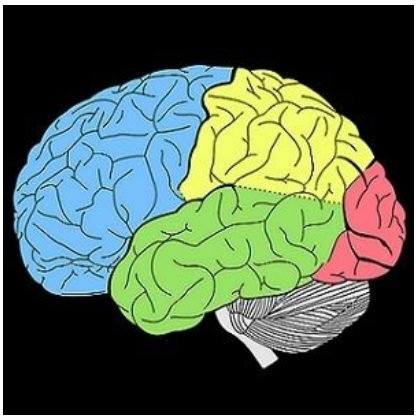
Brain Mystery Solved with IT Approach



Discontinuity of topographic maps in the brain — not signal reduction — reflects sensory impairment, according to new research from Hebrew University. The findings, published in the journal *Proceedings of the National Academy of Sciences (PNAS)*, shed light on a longstanding mystery of a fundamental property of the brain.

It has long been known that the brain uses topographic organisation, meaning that parts of the brain that make similar types of computations are situated close to each other (also known as brain maps or spatial computation). However, in the case of pathology, these topographies may undergo re-organisation.

Now, the new research findings show that it is the continuity of these brain maps which is disturbed. In addition, this continuity can be quantified, providing a useful biomarker for detecting neuropsychiatric disease, the researchers say.

Using functional MRI (fMRI), the researchers studied two types of unique patient populations: patients with injury to one side of the spinal cord, which enabled comparison of disturbed and non-disturbed body sides, and patients undergoing surgical repair. This approach enabled direct comparison in human patients with respect to their own self or before and after surgical intervention. Moreover, the patients could report their subjective experience, which is crucial for understanding high cognitive functions and neuropsychiatry.

The researchers developed an algorithm that quantifies continuity of the patients' brain maps. Their results showed that, in each individual patient, pathological processing was reflected by a discontinuity of topographic maps rather than signal reduction.

"These findings suggest that continuity is a primary principle in brain computation, but in pathological states the brain may give up on this principle in order to retrieve as much information as possible," explains neuroscientist Dr. Shahar Arzy, director of Hebrew University's Computational Neuropsychiatry Laboratory, who led the research team. "Moreover, this may serve as a biomarker for neurological pathologies that we are now investigating."

Dr. Arzy and colleagues are now fine-tuning their findings in neurosurgical patients in order to enable a better patient-tailored diagnosis and follow-up. In addition, the team is extending their findings to other kinds of brain processing such as vision, hearing, number processing and memory.

Source: Hebrew University

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