

Biomarker of adult human neurogenesis enables studies of aging and depression

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The discovery of adult neurogenesis has opened a new era in modern neurobiology: the brain, after all, has the capacity to regenerate. In the mammalian brain, new neurons are continuously formed in the hippocampus, the center for learning and memory. In animal models, newborn neurons are important for cognition, mood and stress regulation. In humans, it is estimated that about 700 new neurons are integrated daily into the hippocampus, but their functional importance is not known because of the lack of a live and non-invasive measure. Based on a series of experiments using magnetic resonance spectroscopy (MRS), we identified a fatty acid-related metabolite that is highly enriched in neuroprogenitors and visible at 1.28 ppm on the resonance spectrum. To enable detection of the neuroprogenitors in the human brain, we developed an analytical algorithm that allows automated and objective quantitation of the 1.28 ppm spectroscopic signal obtained by 3T MRS. Using this method, we can distinguish neurogenic and non-neurogenic areas in the human brain. Further, we discovered that the neurogenic signal is associated with age and depression. Strikingly, in medication-resistant depressed individuals, electroconvulsive treatment provokes a two-fold signal increase—a leading indicator that predicts subsequent hippocampal plasticity and clinical outcome. Overall, we now have the means to study neurogenesis in the live human brain and provide new insights on the role of this process in human brain function, dysfunction and treatment response. Moreover, this method may be used to trace activated and/or stem cells transplanted into the human brain, already in clinical trials for stroke and multiple sclerosis.

Biography

Mirjana Maletic-Savatic is a Board-Certified Neurologist and a Physician/Scientist interested in the interactions between genes and environment, particularly those that affect learning and memory. The new concepts and analytic algorithms she and her team have developed at the bench have the potential to change the standard of clinical care, ultimately leading to improved diagnosis, prognosis and individualized treatment of our patients. She is the Recipient of numerous awards and has published extensively in top-tier journals.

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