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Modern models of brain diseases for translational studies

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Motivation and Aim: Development of new *in vivo* and *in vitro* models of brain diseases is one of the objectives of translational studies in Neuroscience. Solving this problem will ensure progress in understanding the mechanisms of brain functioning, deciphering the pathogenesis of central nervous system diseases (neurodegeneration, neurodevelopmental disorders, neuroinflammation, etc.) [1–4].
Methods and Algorithms: Using modern protocols of cell biology, neurobiology, and bioengineering, we have developed several original models of the neurovascular unit, neurogenic niche, and blood-brain barrier *in vitro*. These models allow us to reproduce some important aspects of intercellular communication, metabolic control, neurogenesis, angiogenesis/barriergenesis, functional activity and damage of neuronal, glial, and endothelial cells.
Results: We will present an analysis of up-to-date methods and approaches to *in vitro* modeling of brain tissue, application of various multicellular ensembles, scaffolds and structures to reproduce the mechanisms of plasticity, protocols used for monitoring the viability and functional competence of cells and tissues, and key criteria applied for such models, as well as prospects for their further improvement.
Conclusion: The choice of an adequate model and biomarkers is a key success factor in translational research in medicine. Modern technological solutions make possible the most reliable reconstruction of mechanisms of brain plasticity in the *in vitro* systems as well as to promote the development of new pharmacological agents with precise targeting and high efficacy.

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