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Biopolymers Based Membranes for Imitation Blood-Brain Barriers †

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Abstract: The blood-brain barrier (BBB) is a physiological barrier that actively interacts between the circulatory system and the Central nervous system. Simulating the functioning of the BBB is one of the most important tasks. The result will have significance for not only fundamental science but also for applied science. It is known that the physiological permeability of the BBB is disturbed in various pathologies of the Central nervous system (ischemia, brain hypoxia, injuries and tumors, neurodegenerative diseases). Changes in permeability are selective and often with ineffective pharmacotherapy. Therefore, if scientists can simulate the barrier, they can conduct optimal studies of the efficiency of drugs. The simulated barrier is composed of membranes and three types of basic cells, astrocytes, endothelial cells, and pericytes. Several requirements are imposed on the membrane, such as the passage of water and small molecules, formation of close contact with cells, and control of large molecules passage. In this work we use gelatin-based film for BBB imitation due to its high biocompatibility. Since gelatin is initially water-soluble, we modified it with methacrylate groups to make it able for cross-linking. Four modified gelatin membranes that differ in the degree of cross-linking were obtained by varying the concentration of photoinitiator methacrylate groups and the time of UV radiation. The obtained membranes were used to study their biological properties, immunohistochemistry, cell proliferation, and morphometry. It was shown, that membrane with an average degree of cross-linking demonstrated the optimal properties for cell adhesion and proliferation.

Keywords: blood-brain barrier; modified gelatin; polymer films; experimental models; astrocytes; endotheliocytes; pericytes

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