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ПРОБЛЕМИ ТА ДОСЯГНЕННЯ СУЧАСНОЇ БІОТЕХНОЛОГІЇ

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МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
КАФЕДРА БІОТЕХНОЛОГІЇ

MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF BIOTECHNOLOGY

ПРОБЛЕМИ ТА ДОСЯГНЕННЯ СУЧАСНОЇ БІОТЕХНОЛОГІЇ

PROBLEMS AND ACHIEVEMENTS OF MODERN BIOTECHNOLOGY

Матеріали
V міжнародної науково-практичної конференції

Materials
of the V International Scientific and Practical Conference

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reached 10 mm. The chains were observed in cultures for 2 months after formation, afterwards they disintegrated.

The presented results showed that the described way for obtaining and culturing neonatal rat brain NC allowed the obtaining of the aggregates consisting of NSPCs capable of proliferation, differentiation and migration. Neuroblasts formed as a result of NSPC differentiation are capable of active tangential migration, which indicates their potential ability to colonize damaged areas of the brain.

The presented simple, inexpensive and effective method for obtaining and culturing neonatal rat NSPCs allows them to be used as models in medical-biological, biotechnological and pharmacological studies.

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All experiments involving animals were carried out with the approval of the Bioethics Committee of the Institute for Problems of Cryobiology and Cryomedicine, (Protocol № 2 dated 23/02-2021).

Glycerol affects Ca^{2+}-dependent regulation of Ca^{2+}-ATPase activity in human erythrocytes

Zemlianskykh N. G.

Institute for Problems of Cryobiology and Cryomedicine of the National Academy of Sciences of Ukraine, Kharkiv, Ukraine

nzemliansky@gmail.com

Glycerol is widely used in the pharmaceutical, medical and food industries as a solvent, viscosity regulator and emulsifier. In biobanking practice, this substance serves as a cryoprotective agent to stabilize various types of cells and tissues under stressful cryopreservation conditions. In particular, glycerol is involved in cryopreservation of human erythrocytes that allows preserving donor blood for a decade or more at ultra-low temperatures (–80°C – (–196°C)) with subsequent taking it

for transfusion with minimal loss of quality after thawing. Cryobiological technologies provide reserves of biological material for transfusion in cases of mass human injuries during military operations, as well as natural and technogenic disasters.

Despite the fact that glycerol ensures a high level of survival of erythrocytes during cryopreservation in liquid nitrogen (–196 °C) this method is recognized as labor-intensive and expensive. This stipulates the improvement of biotechnological approaches for long-term blood storage. Along with this, the high level of viability of erythrocytes cryopreserved under the glycerol protection determines the need to investigate the functioning features of various subcellular components in its presence to understand the mechanisms of cell stabilization in order to use the data obtained for improving and developing new cryopreservation methods.

Ca^{2+}-ATPase is the only membrane system that maintains a low level of Ca^{2+} in the cytoplasm. Under physiological resting conditions, the Ca^{2+} level in cells is very low and the activity of Ca^{2+}-ATPase is negligible. However, upon receiving a mediator signal or impairment of the barrier properties of the membrane, the level of Ca^{2+} in cells rapidly increases due to a 1000-fold gradient between the extra- and intracellular media. Activation of Ca^{2+}-ATPase upon an increase in the concentration of the ion is mediated by the Ca^{2+}-calmodulin complex.

The aim of the study was to determine the role of Ca^{2+}-calmodulin dependent regulation in changing the activity of Ca^{2+}-ATPase in erythrocytes upon exposure to glycerol at the stage prior to freezing.

It was found that exposure of saponin-permeabilized erythrocytes to 10% glycerol increased the Ca^{2+}-ATPase activity. Augmentation of the glycerol concentration above 20% inhibited the enzymatic activity of the Ca^{2+}-pump. Using the inhibitor of calmodulin-dependent reactions R24571 showed that stimulation of Ca^{2+}-ATPase by 10% glycerol was observed when the inhibitor was introduced into the suspension after modification of the cells with a cryoprotectant and disappeared if it was added before contact of the erythrocytes with glycerol. Introduction of the inhibitor R24571 before adding glycerol to the cell suspension isolated calmodulin from participation in the regulation of Ca^{2+}-ATPase and did not allow observing

stimulation of the enzyme activity. Introduction of the inhibitor R24571 into the cell suspension after glycerol has already been included in the medium, i.e. under conditions when calmodulin and Ca^{2+}-ATPase have potentially already interacted with each other, did not have a significant effect on the activity of Ca^{2+}-ATPase and served as additional confirmation of the calmodulin role in the regulation of Ca^{2+}-ATPase in the presence of 10% glycerol. Stimulation of the catalytic activity of the Ca^{2+}-pump under the cryoprotector effect at concentrations corresponding to the initial stage of cell saturation, reveled in saponin-permeabilized erythrocytes, can contribute to their stabilization. Under these conditions, the stimulation can compensate for the increase in the rate of Ca^{2+} entry into the cell that is caused by disturbances in the membrane structure stipulated by the osmotic effect of the glycerol medium.

Thus, glycerol can affect the Ca^{2+}-ATPase of erythrocytes via calmodulin. This creates the possibility, through the control of the Ca^{2+} level, to change the metabolic and structural state of the cells and stabilize erythrocytes during cryopreservation under the protection of glycerol.

Біотехнологія та продукти здорового харчування

Абаровський А. Ю., Кравченко Н. В.

Сумський національний аграрний університет, м. Суми, Україна

arsenijabarovskij@gmail.com

Харчова біотехнологія, як наука сформувалася на основі традиційних методів ферментації, які людство використовувало тисячоліттями. Перші біотехнологічні процеси (бродіння для отримання хліба, пива, сиру, вина) виникли ще в давніх цивілізаціях — у Месопотамії, Єгипті, Китаї, Греції, але окремою ця наука стала у 19-20 столітті. Наразі вона має багато напрямків, основними є:

Ферментаційні процеси (виробництво молочнокислих продуктів, хліба, пива, вина, соєвих соусів тощо).