Brief information about the project

Name of the project	AP19678607 "Calcium-dependent mechanisms of rhythm control of brain neurons during hyperexcitation (government registration № 0123PK00430).
Relevance	Disturbance of rhythmic activity of different brain regions is observed in many neurodegenerative diseases, and exceeding the limit frequency of AP packs, observed in hyperexcitation and ischaemia, can lead to neuronal death. Moreover, in many cases selective death of some groups of neurons is observed. Pyramidal neurons of the hippocampus are thought to be the most vulnerable. However, in a number of pathologies, such as epilepsy, ischaemia and hepatic encephalopathy, selective death of certain populations of GABAergic neurons is observed. The molecular mechanisms of generation of slow rhythmic depolarisation impulses, which form neuronal pack activity during hyperexcitation, and their regulation have not been established at present. Therefore, elucidation of the mechanisms of control of synchronous rhythmic activity of neurons in different brain regions is an urgent fundamental task.
Purpose	The aim of the project is to elucidate the role of Ca2+ ions in the regulation of periodic synchronous activity of hippocampal neurons in hyperexcitation, ischaemia and epilepsy.
Objectives	1. To study the nature of periodic pulses of slow depolarization (PDS cluster) in epilepsy: mechanisms of induction, mechanisms of regulation. The role of various Ca2+ channels (voltage-dependent calcium channels, NMDAR, GABA(A) receptors and Ca2+ concentration in slow depolarization impulse generation. 2. To evaluate the contribution of calcium-conducting glutamate channels, voltage-dependent Ca2+-channels of T- and L-type in the generation of calcium impulse and in the formation of the structure of the PDS cluster; show the correlation between the concentration of Ca2+ and the amplitude of slow depolarization in the PDS cluster (in the PD burst). 3. To reveal the mechanisms of participation of calcium channels in the termination of a burst of AP due to the activation of calcium-dependent K+ and Cl- channels; 4. To reveal the mechanisms of participation of calcium channels in the mechanisms of synchronization and desynchronization of the activity of neurons in the network; 5. To find out the causes of rhythm disturbances in the electrical activity of brain neurons in the bicuculline model of epilepsy. 6. To study the effect of agonists of various metabotropic receptors, triggering Ca2+ oscillations in the cell, on the parameters of the synchronous activity of neurons; To study the effect of metabotropic receptors coupled to G-proteins on the duration of the slow depolarization pulse (on the parameters that determine the termination of the PDS cluster). 7. On the basis of the results obtained, to propose methods for restoring violations of the parameters of the rhythmic activity of neurons in epilepsy and ischemia.
Expected and achieved results	The project will reveal the mechanisms of participation of various calcium channels and intracellular concentration of calcium ions in the emergence and modulation of the synchronous activity mode of brain

	neurons. The reasons for the disruption of the rhythm of electrical activity of brain neurons in neurodegenerative diseases such as epilepsy and ischaemia will be elucidated. Mechanisms of synchronisation and desynchronisation of neuronal activity in the network will be elucidated. New pharmacological drugs inhibiting synchronous hyperexcitation of brain neuron populations will be proposed.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	Project Manager: Tuleukhanov Sultan Tuleukhanovich, Doctor of Biology, Professor, Corresponding Member of the National Academy of Sciences of the Republic of Kazakhstan, Academician of the National Academy of Sciences of Higher School of Kazakhstan; Head of the Laboratory of Biophysics, Chronobiology and Biomedicine; h-index=7; Researcher ID Web of Science: DZT-2440-2022; ORCID: https://orcid.org/0000-0002-9898-0507; Scopus author ID: 52964678500. Members of the research team:: 1. Ablaikhanova Nurzhanyat Tatukhanovna Candidate of Biological Sciences, Associate Professor; Senior Researcher; h-index=4; ResearcherID Web of Science: N-4881-2014 ORCID: https://orcid.org/0000-0001-7288-1917; Scopus author ID: 57197818487. 2. Tussupbekova Gulmira Ablaevna Candidate of Medical Sciences, Associate Professor; Senior Researcher; h=3; Researcher ID Web of Science: GEK-6286-2022; ORCID: https://orcid.org/0000-0001-9379-4687; Scopus Author ID: 57201525842. 3. Kenzheyeva Zhanar Kuralbaevna PhD, Researcher; ResearcherID Web of Science: GBU-3166-2022 ORCID: https://orcid.org/0000-0002-0890-8035; Scopus author ID: 57330878300. 4. Kairat Bakytzhan Kairatuly Researcher; ResearcherID Web of Science: AAF-2100-2019; ORCID: https://orcid.org/0000-0003-1742-2667 Scopus author ID: 58317238000. 5. Malibayeva Araylym Erzhankyzy PhD student, Junior Researcher; h=1; ResearcherID Web of Science: DFN-8696-2022; ORCID: https://orcid.org/0000-0002-4759-9087; Scopus Author ID: 57219195116. 6. Abu Nurila Bauyrzhankyzy, Master of Pedagogical Sciences, Junior Researcher. 7. Sattigulova Zanzamgul laboratory assistant.
List of publications with links to them	1. Zinchenko V.P.; Kosenkov A.M.; Gaidin S.G.; Sergeev, A.I.; Dolgacheva L.P.; Tuleukhanov S.T. (2021) Properties of GABAergic Neurons Containing Calcium-Permeable Kainate and AMPA-Receptors. Life 2021, Volume 11 , Issue 12, 1309. Индекс цитирования -1, Q2 IF: 3.253, Процентиль – 41%, https://doi.org/10.3390/life11121309 . 2. Ossikbayeva S., Khanin M., Sharoni Y., Trachtenberg A., Tuleukhanov S., Sensenig R., Rom S., Danilenko M., Orynbayeva Z. (2021) Curcumin and Carnosic Acid Cooperate to Inhibit Proliferation and Alter Mitochondrial Function of Metastatic Prostate Cancer Cells. Antioxidants (Basel, Switzerland), 10(10), 1591. Индекс цитирования – 6, Q1 IF: 7.675, Процентиль – 85 %, https://doi.org/10.3390/antiox10101591 . 3. Shapovalov, Y.A., Gladyshev, P.P., Tuleukhanov, S.T., Shvetsova, E.V., Abdrasulova, Z.T. Radicals in Cellular Structures// Biophysics

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