

Brief information about the project

Title	AP23486255 «The Study of Functional Brain Networks and Cognitive Function Mapping in Patients with Brain Tumors»
Relevance	The study of functional brain networks and cognitive function mapping in patients with brain tumours using non-invasive multimodal neurovisualization is an important task for advancing pre-surgery diagnostics of brain tumour pathologies. According to literature preoperative functional magnetic resonance imaging (fMRI) helps minimise cognitive impairments after surgical procedures. Therefore, the investigation of the functional brain networks and cognitive mapping on an expanded sample by using Diffusion Tensor Imaging (DTI), functional Magnetic Resonance Imaging (fMRI), functional near-infrared spectroscopy (fNIRS), and electroencephalography (EEG) during resting state and the performance of cognitive tasks is necessary. The application of modern brain signal analysis, including machine learning and artificial intelligence, will allow the prediction of tumour impact on cognitive functions.
Goal	The project aims to examine the functional brain networks and cognitive function mapping in patients with brain tumours using non-invasive multimodal neurovisualization during resting state and cognitive tasks performance.
Tasks	<ul style="list-style-type: none"> - Describe research background and validation of methodology in Kazakh and Russian language to conduct complex multimodal study in patients with brain tumour. - Development of pipeline for multimodal brain signals statistics in patients with brain tumour and control group. - Determination of functional connectivity in patients with brain tumours compared to the control group. - Comparison of BOLD (Blood Oxygenation Level Dependent) signal during resting state among patients with different levels of malignancy. - Defining differences in brain signal during the cognitive tasks performance in patients with brain tumours compared to the control group. - Determination of the informativeness of source activity of signal. - Development and validation of EEG and fNIRS signals for cognitive function mapping. - Application of machine learning algorithms to predict the impact of tumours on the functional brain networks and cognitive functions. - Articles will be published in accordance with the requirements for the project in section 7 of the competition documentation.
Expected and Achieved Results	<p>Expected Results:</p> <ul style="list-style-type: none"> - Complex methodology for multimodal examinations of patients with brain tumours will be developed and validated in Kazakh and Russian languages. - Multimodal experiment design in participants with brain tumours and the control group will be validated. Optimal preprocessing protocols for individual and group brain signals analysis will be determined. - Differences in functional brain network connectivity during the resting state between patients with brain tumours and control group will be identified. - The informativeness of BOLD (Blood Oxygenation Level Dependent) signals for determination of the level of malignancy will be established. - Characteristics of signal during the performance of cognitive tasks in patients with brain tumours compared to the control group will be determined. - Informative parameters of EEG and fNIRS will be identified based on acquired (bought) equipment. The informativeness of the sources imaging

	<p>will be revealed. Additional methods for accurate mapping of cognitive function will be developed.</p> <ul style="list-style-type: none"> - Machine learning algorithms will be applied to the results of preprocessed individual data to predict the impact of tumours on the brain networks and cognitive functions. - Articles will be published in journals according to project requirements set out in part 7 of competition documentation.
Names and Surnames of Research Group Members with Their Identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and Links to Corresponding Profiles	<p>1. Kustubayeva Almira, Candidate of Biological Sciences, Professor, Project Supervisor H-index – 9. Web of Science Researcher ID - O-3664-2017 https://www.webofscience.com/wos/author/record/1415099 ORCID: 0000-0001-6575-6288 https://orcid.org/0000-0001-6575-6288 Scopus ID: 48861267200 https://www.scopus.com/authid/detail.uri?authorId=48861267200</p> <p>2. Zholdassova Manzura, PhD H-index – 3 Web of Science Researcher ID - ABF-2728-2021 https://www.webofse.cociencm/wos/author/record/2431494 ORCID:0000-0002-8186-9650 https://orcid.org/0000-0002-8186-9650 Scopus ID: 57211453898 https://www.scopus.com/authid/detail.uri?authorId=57211453898</p> <p>3. Kamzanova Altyngul, PhD H-index – 5. Web of Science Researcher ID - N-9752-2014 https://www.webofscience.com/wos/author/record/307147 ORCID: 0000-0002-7097-3460 https://orcid.org/0000-0002-7097-3460 Scopus ID: 48861537900 https://www.scopus.com/authid/detail.uri?authorId=48861537900</p> <p>4. Bayturlin Zhanibek Candidate of Medical Sciences, Professor, JSC "National Center of Neurosurgery" ORCID: https://orcid.org/0009-0007-5176-6662</p> <p>5. Arman Diana, PhD H-index - 2 Scopus Author ID: 57055918000 https://www.scopus.com/authid/detail.uri?authorId=57055918000</p> <p>6. Melnikov Mikhail, PhD in Biological Sciences H-index - 7 Scopus Author ID 57226345921 https://www.scopus.com/authid/detail.uri?authorId=57226345921 ORCID 0000-0003-4957-1958 https://orcid.org/0000-0003-4957-1958 WoS Researcher ID D-3810-2018 https://www.webofscience.com/wos/author/record/1167274</p> <p>7. Batyrkhanov Daultai, Radiologist, Department of Radiology and Radiosurgery, JSC "National Center of Neurosurgery" H-index - 3 Scopus Author ID 57233160800 ORCID: https://orcid.org/0009-0008-6346-911X</p> <p>8. Uteuova Saule Head of the Neurophysiological Laboratory of JSC "National Center of Neurosurgery" ORCID: https://orcid.org/0000-0003-4136-0742</p>

	<p>9. Akshulakova Gulshat Joint Stock Company "National Center of Neurosurgery", doctor</p> <p>10. Tastanbekova Ainash NGO "Kazakhstan Association of Polygraph Examiners", methodologist ORCID: 0009-0001-2879-5648</p> <p>11. Shakhzadayev Rasul, Bachelor ORCID 0009-0005-1574-8040 https://orcid.org/0009-0005-1574-8040</p> <p>12. Nusiupayeva Aigerim, Master's Degree, Master of Economic Sciences</p>
Publications list with links to them	<p>Kamzanova A., Zholdassova M., Tastanbekova A., Berdibayeva D., Kustubayeva A. Assessment of Cognitive Functions in Patients with Brain Tumor//Вестник КазНУ Серия психология и социология. 2024 - №3(90). – С. 30-37 https://doi.org/10.26577/JPsS.2024.v90.i3.03 https://bulletin-psysoc.kaznu.kz/index.php/1-psy/article/view/2052</p>